EDITORIAL

THE major item of scientific news at the moment is the presence of the satellite Sputnik which, at the time of writing, is still circling the globe.

It is, in fact, the most important single event man has brought about. It has been distilled from every branch of technical knowledge, not only in the achievement of placing it in its orbit but in the production of devices for observing it and calculating the forces controlling its path and behaviour.

We have succeeded in extending our reach almost to the limit of the earth's immediate control.

The next step will be to probe into the problems of outer space.

It is inevitable that, because of the present political state of the world, the relation of the satellite to warfare and national prestige should have exercised many minds. In fact, judging from some of the ocean of comments published in the Press, the satellite might be a menace to our civilisation.

But, as I watched the tiny pin-point of light rushing across the sky, I could not see it that way.

The future of mankind does not lie in avoiding knowledge. It lies rather in the hearts and the minds of those who use what man's brains have discovered.

In this respect, the satellite is no different from any other technological achievement.

Who would now seriously suggest we should abandon atomic research because of the weapons it enables us to build? We know now that it really represents a source of useful power far beyond our dreams.

In the same way, the use of earth satellites will eventually open up fantastic new fields of knowledge, and while we live we cannot escape the responsibilities which follow.

In the long-term history of the world, the importance of who first succeeded in establishing a satellite will be a minor matter. The ability to do so is not confined to one nation, and will soon be shared by others.

What we must all appreciate is the beginning of a new era in human history, human thought, and human endeavour.

It is not too much to suggest that, because of it, man's relations with his neighbours might begin anew.

I cannot subscribe to the thought that we should approach these expanding horizons with fear and dread. Our vision must be wider than that.

John Moyle

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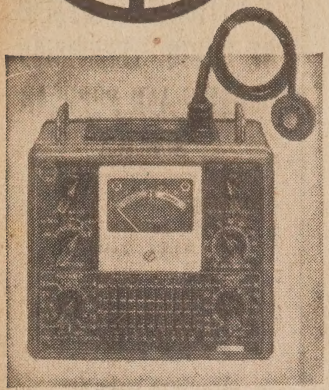

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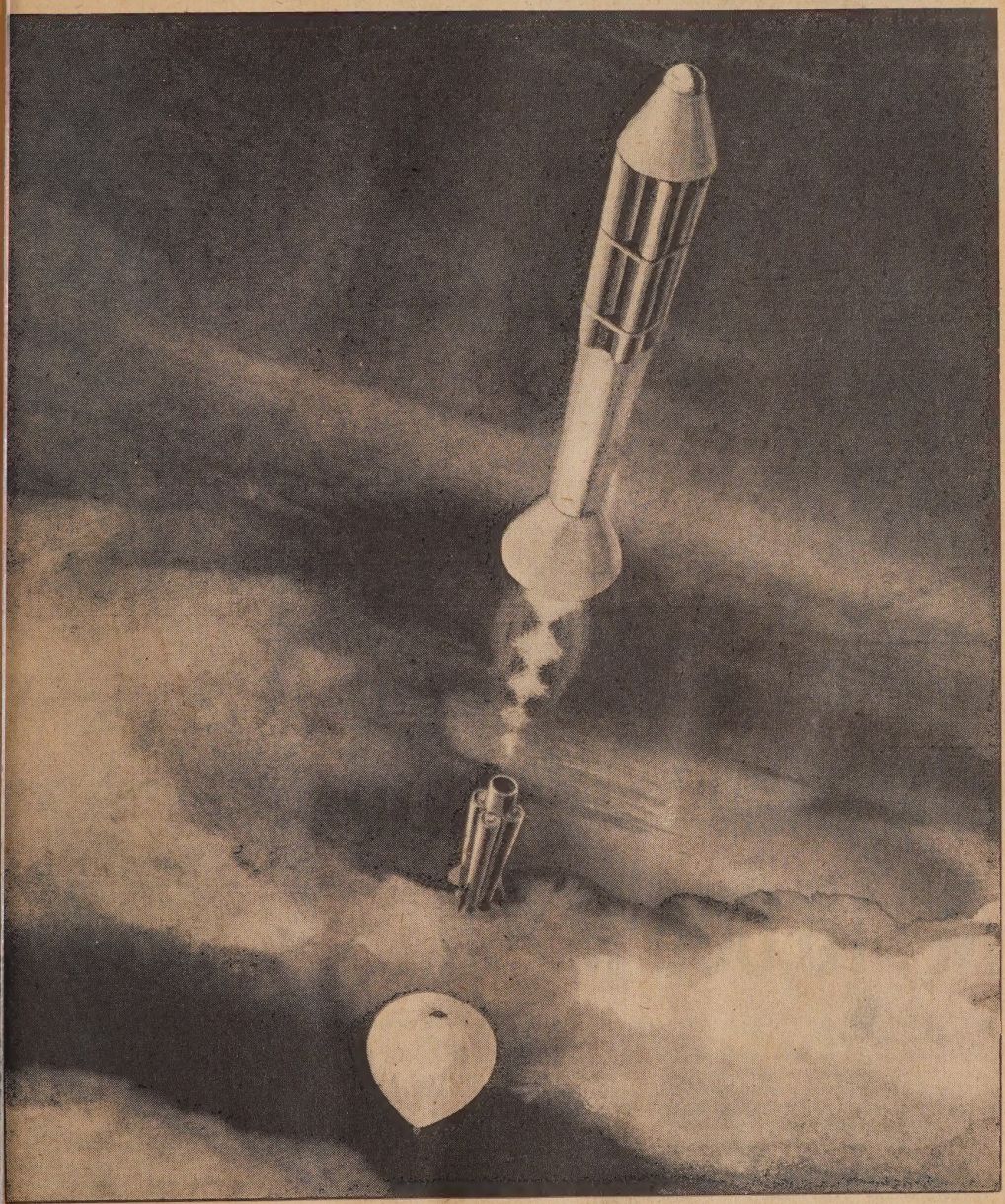
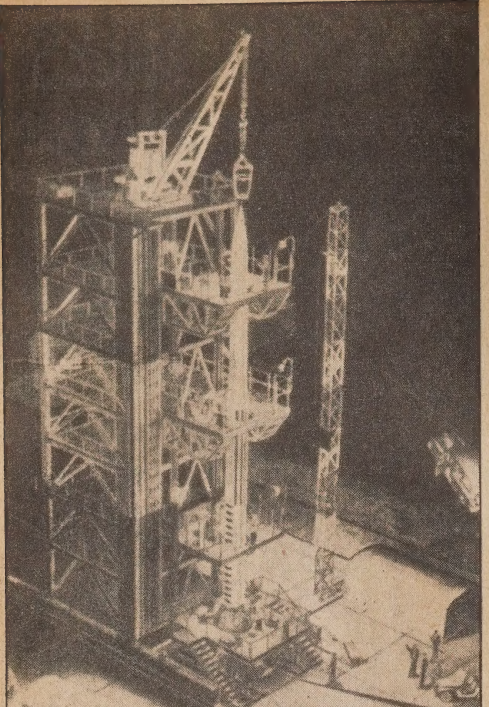
ROCKET WILL RISE 4,000 MILES



Far higher than the Sputnick satellite, this Far Side vehicle is due to rise in the next few weeks to a height of between 1,000 and 4,000 miles. Sponsored by the American Air Force Research and Development Command, it is designed for study of cosmic rays and the earth's magnetic field at extremely high altitudes. The vehicle will be lifted to approximately 100,000 ft. by a huge balloon before being fired to avoid passing through denser atmosphere at speed. When fired, it will shoot right through the balloon as shown in this picture, and its four-stage rockets will send it into space. It will be fired from Eniwetok Atoll in the Pacific.



This is the equipment to be used for the Vanguard 3-stage vehicle. In the background is the gantry crane used for erection and assembly and to provide work platforms. Lower right is a concrete blockhouse for monitoring prior and during flight. Final tests will be remotely controlled. A steel exhaust duct will carry away gases during firing. Stabilisation will be provided by a gimbaled engine.

Precision Steering At 18,000 M.P.H.

The launching of the Russian earth satellite last month has swung a good deal of attention and importance away from the American Vanguard project which called for a smaller satellite to be launched probably early next year. It has, however, increased still further the interest in the methods behind satellite engineering, which remains substantially the same no matter who is responsible for details of development.

WE shall probably not be told a great deal about the Russian project, but this article, by arrangement with Radio and TV News, presents an excellent summary of the problems to be overcome and the methods used to elevate the Vanguard satellite, and to control it until its orbit is reached. Obviously it is only a matter of time before earth satellites are no longer novelties in the scientific world.

The day of the satellite would still be a long way off if it were not for the great strides made recently in rocket propulsion structural design, and electronics. A satellite launching system draws upon these technologies to the limits of their development.

The "Vanguard" vehicle is a three-stage rocket powerful enough to vault through the earth's atmosphere to orbiting altitude of 300 miles. If it did no more, the satellite would immediately fall back to earth. It must, therefore, be able to accelerate to the amazing velocity of 18,000 miles-per-hour—the rate that offsets the centripetal pull of gravity at that altitude, and thereby makes orbital travel possible.

The 11-ton vehicle must have a means, moreover, of controlling this great lifting strength and velocity so that the satellite will follow a path that roughly parallels the earth's contour.

Three big demands are thus laid down for the satellite vehicle. It must lift the satellite to a height of 300 miles, accelerate it to 18,000 miles-per- hour, and then at that altitude and velocity — it must set the satellite free on a path that approximates a tangent to the earth's surface. That these capabilities may be built into a single vehicle of manageable size and cost is a tribute to the state of advancement in rocketry, electronics and allied fields.

THE THREE STAGES

The composite vehicle, resembling a gigantic rifle shell, is about 72 feet long and 45 inches at its greatest diameter. The first two stages are powered by liquid propellants and guided by an inertial reference system. The third stage, which carries the spherical satellite, is powered by solid propellant and is maintained in fixed orientation while it is firing.

The first stage is a liquid propellant rocket. Serving essentially as a guided booster, it develops most of the energy to raise the remaining stages to orbital height and about fifteen per cent of the required orbital velocity.

The major propellants, liquid oxygen and kerosene, are contained in tanks that are integral with the airframe skin. The rocket motor is fed fuel by turbine-driven pumps. The pressurising gas is helium. Control of the vehicle's orientation and flight path is attained by movements of the engine which is mounted on a gimbal.

In response to autopilot commands the engine is tilted by electro-hydraulic actuators to alter the direction of thrust and thus control deviations in pitch and yaw. Roll control is provided by small auxiliary jet reactors.

The second stage of "Vanguard" carries the entire guidance and control system. In addition it supplies the remaining energy needed to reach orbital height and about 30 per cent of the orbital velocity. It is a liquid propellant rocket that is sliced to the forward end of the first stage.

The propellants, nitric acid and unsymmetrical dimethyl hydrazine, are fed directly to the motor from high pressure tanks integral with the airframe skin.

Again the pressurising gas is helium. The motor is gimbal mounted, as in the first stage, and positioned in pitch and yaw by electro-hydraulic impulses.

An array of jet reactors provides complete control of orientation during second-stage coasting flight. Forward of these various mechanisms, the second stage houses within its nose—which is the nose of the entire vehicle—the third stage and the satellite.

The plastic nose cone protects the delicate satellite sphere from the aerodynamic heating it would encounter if exposed during the first part of the ascent through the atmosphere. The cone is jettisoned early in the second stage burning phase after which the atmosphere is too thin to be detrimental to the satellite.

The third stage is a solid-propellant, unguided rocket. By approximately doubling the speed attained by the end of second

SATELLITE LEVELS INTO FLIGHT

ge coasting flight, it imparts the ,000 mile-per-hour velocity required r the satellite to begin its free-flight bit around the earth.

In the absence of guidance—jettisoned the time of second stage separation—is third stage maintains stability by ing spun about its longitudinal axis in e manner of a rifled shell.

While still attached to the second stage is mounted on a turntable, or spin ng mechanism. Near the end of second ige coasting flight, the turntable is set motion by small retro-rockets fire—tarding the flight of the second stage ell. The momentum of the third ige-satellite combination, however, mains unchecked. Thus freed, the final cket begins its powered flight.

The satellite payload, a 20-inch sphere, attached to the forward end of the ird stage, and may be separated when bital velocity has been attained. As e third stage will reach orbital velocity, hen separated from the payload, it also ill become a satellite.

RBITAL CHARACTERISTICS

Even at altitudes of 300 miles and ove there is a minute drag. Over a riod of time this drag will retard the tellite's velocity and thus lower its titude, so that it will describe a de-lerating, descending spiral. When it scends to atmosphere of sufficient nsity, the satellite will burn and dis-tegrate.

Based on present estimates of densities, ientists calculate that the satellite could ist in a circular orbit of 300 miles eight about one year. If the height aries from 200 to 1,500 miles at the west and highest points (perigee and pogee), the lifetime would be only 15 ays. A 100-mile perigee would end the tellite's career within an hour.

The preferred orbit—a nominal cir-le 300 miles above the surface of the arth — could be attained only if the ngle and velocity of firing were con-olled perfectly. Inevitable control er-ors, however, will result in an ellip-cal orbit.

It is intended that the initial orbit vill lie between 200 and 1,500 miles ltitude. A greater apogee would hin-er optical tracking while a perigee be-ow 200 miles would seriously reduce the ife span of the man-made moon.

CONTROL SYSTEM

Correct angle of injection depends n correct functioning of the control ystem which steers the "Vanguard" ehicle over the predetermined trajec-ory.

It employs a magnetic amplifier auto-ilot working in conjunction with an nertial reference guidance system.

The course is set into the system be-ore launch and played back via a mas-er sequence controller which initiates ach phase of flight at precisely the right noment.

It is thus unlike other guidance sys-ems that employ radar to track the ocket, issuing steering commands from he ground with the help of a computer.

All control equipment is located in he electronic section of the second tage. Heart of the guidance system is a trio of single-axis, rate-integrating gyros.

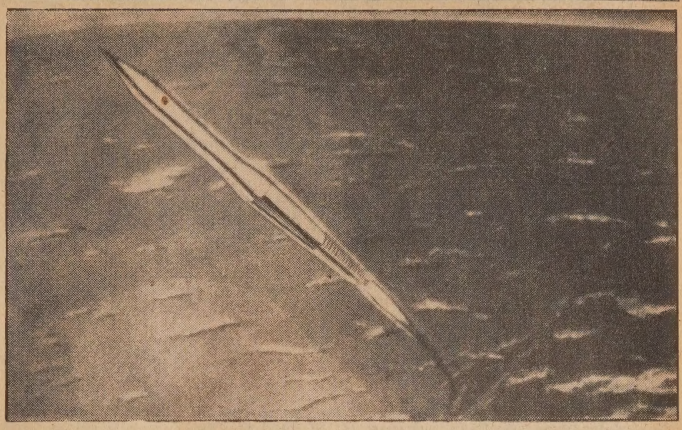
One is aligned with the "yaw" axis, another with the "pitch" axis, and the hird with the "roll" axis.

Once set and stabilised in a particular plane, the gyros remain fixed in that plane despite contrary movements of the vehicle. Roll and yaw orientation are fixed, while the pitch reference is pre-programed to establish the curving trajectory planned for the rocket.

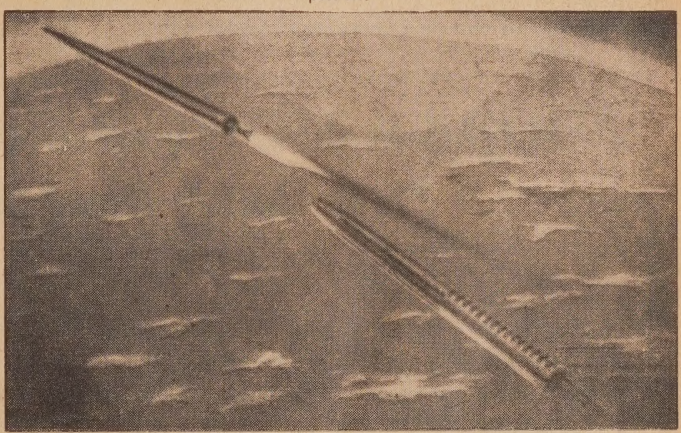
Let's say the heading of the vehicle changes from the desired direction because of a gust of wind, sloshing of fuel in the tanks, or irregularity of the rocket engine. The deviation is sensed by the yaw gyro, which remains set on the correct course.

The gyro sends out proportionate electrical signals to the autopilot, which, operating through electro-hydraulic actuators, causes the rocket controls to bring the vehicle back on course. Deviations in roll and pitch are corrected in similar fashion.

The phase lead required to stabilise the rocket is produced by operational networks that introduce a phase lag in the feedback circuit of the amplifiers.



The first stage, powered by a liquid rocket engine, employs liquid oxygen and kerosene as fuels. The thrust cylinder extends aft of the rocket structure. This cylinder is moved by hydraulic actuators in a gimbal system so that flight path control is possible.



The second stage of the vehicle, shown at left, contains a liquid rocket engine, designed and built by Aerojet-General Corporation. A gimbal mounting system and hydraulic actuation units similar to those employed in the first stage are used for control of the thrust vector during the second stage burning cycle.

Using the conventional equations for a feedback amplifier:

$$K_f = \frac{K}{1+BK}$$

where: K_f = gain with feedback
K = forward gain

$$B = K_b \frac{1}{1+(RCS/2)}$$

where: K. is a function of the number of turns on the feedback winding and the values of the resistances.

On substitution we obtain: $1+(RCS/2)$

$$K_f = \frac{K}{1+\frac{KK_b}{1+(RCS/2)}} = \frac{K}{1+KK_b} \frac{1+(RCS/2)}{1+\frac{(RCS/2)}{1+KK_b}}$$

When compared with a conventional lead circuit, this equation shows that the time constant, T, is given by (RCS/2) and the attenuation by 1 plus KKb

(Continued on Page 7)

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NEW BATTERY PROMISES CHEAP, SILENT POWER

A new cell being developed in America enables electrical energy to be obtained directly from chemical energy and may revolutionise our ideas of portable power sources. It has already been used to power a small radar set.

STRIPPED to bare essentials, the cell consists of a number of porous carbon tubes enclosed in a plastic cylinder in such a way that gas can pass through the length of the holes in the tubes. Surrounding the outside of the tubes and contained by the plastic cylinder is potassium hydroxide. Hydrogen gas is passed down the centre of one of the carbon electrodes and oxygen is passed down the other.

Each of the gases finds its way through the porous carbon walls and finally makes contact with the potassium hydroxide where a chemical reaction takes place. Hydrogen and the hydroxide combine forming water and releasing an electron while the oxygen and the potassium left from the previous reaction combine to form more hydroxide.

The electron released by the first reaction is able to find its way out of the cell via the hydrogen electrode. The circuit is completed through the load circuit and back to the oxygen electrode. It is thus able to do useful work.

For best performance the new cell requires pure oxygen and hydrogen but it has been found that the oxygen tube can be fed with air. Also in the case of the hydrogen tube a considerable amount of impurity can be tolerated before the efficiency of the cell falls off too seriously.

CHEAP HYDROGEN

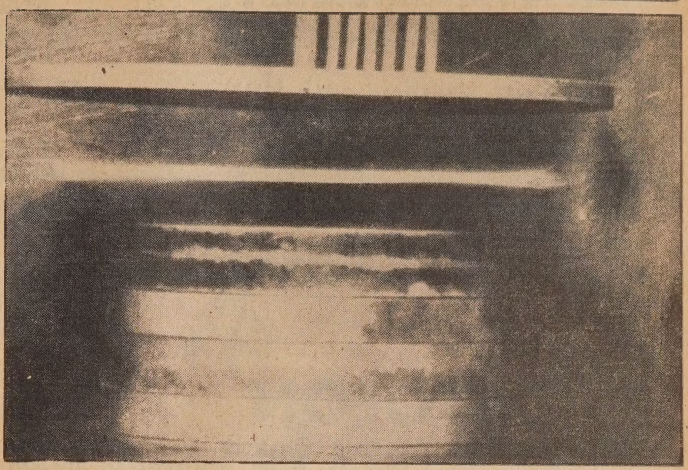
The life of the new cell appears to be indefinite since the energy comes from the gasses and the only by-product of operation is water which can easily be evaporated.

As power generating devices go, the efficiency of the cell is high being of the order of 70 per cent compared with around 30 per cent when hydrogen and oxygen are burned and the heat energy converted to electricity via a steam turbine.

The problem in competing with the sources of power we use today is to find a cheap and reliable source of the hydrogen gas. At the present time hydrogen is comparatively expensive but scientists have several sources in mind. Along with ordinary chemical sources, they suggest that atomic energy may be used to decompose water into the gases, hydrogen and oxygen, which can be used for operation of the fuel cell.

Within sight are batteries capable of producing 1 kilowatt of power, sufficient to operate outboard motors, lawnmowers and many other devices which at the present time are powered by noisy internal combustion engines.

FLAT FLAME HELPS DESIGN JETS



The white streak in this picture is a "Flat" flame which burns while suspended in mid-air. Gas coming from the burner tube below produces a pancake shaped disc of fire (seen here from the edge) which "floats under a copper plate above. It was developed at the Johns Hopkins University to aid in jet fuel research.

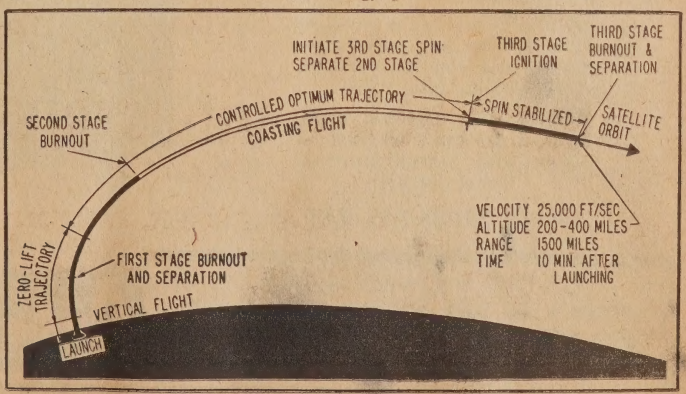
PRECISION STEERING AT 18,000 M.P.H.

(Continued from Page 5)

The all-important velocity of the "Vanguard" vehicle is measured by an integrating accelerometer installed in the second stage electronics section. The instrument senses the acceleration applied to the vehicle during flight, sums it up, and thus yields the velocity. The velocity measurement made at the end of the burning of the second stage is supplied to the unit's analogue computer, which determines how long the vehicle will coast before the third stage, carrying the satellite, is fired.

The basic component is a floated gyro. An acceleration on its sensitive axis generates a signal which, when amplified, drives a turntable which rotates the gyro about its input axis. The resulting torque is equal and opposite to the acceleration torque. Since the turntable turns at a rate proportional to acceleration, its position is proportional to the integral of acceleration, or velocity.

The relation between torque and input angular velocity depends on the angular momentum which, in turn, depends on the power frequency. There are no means of compensating for changes in frequency. Consequently, since the frequency of the 400 cps supply is not controlled accurately enough, it is necessary to generate an accurate 400 cps. This is done by means of a tuning fork whose output is amplified in a transistor amplifier to drive the gyro.



This diagram shows the anticipated path of the satellite's preliminary trajectory.

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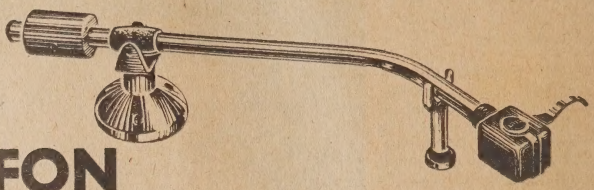

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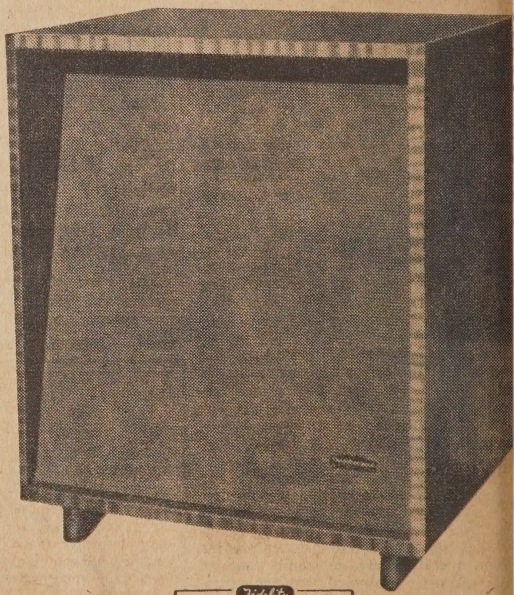

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SPACED AERIALS DETECT STARS

By LANGSTON DAY

Radio Astronomy is one of the most fascinating and important developments of modern science, in which many countries of the world are taking part. The Australian CSIRO is one of the leaders, although it has favored the pencil beam type of aerial array because of its high resolution and freedom from spurious responses. The Cavendish Laboratory of Cambridge in England is another centre of activity in this field, and the new spaced aerial described here is expected to improve considerably on those used to date. In its detection of radio stars, the degree of co-incidence between Australian and British observation is now as high as 30 per cent.

RADIO astronomy was born 26 years ago when a young radio engineer named Karl Jansky, who was working for the Bell Telephone Laboratories, discovered that radio waves from outer space were reaching the earth without being absorbed by the atmosphere. Previously, astronomers could look at the heavens only through an extremely narrow "window" on the wave-band of visible light, but now they are peering through a much wider slit which admits radio waves whose wave-lengths range from about one-tenth of an inch (2.5 millimetres) to 30 yards (27.4 metres).

AERIAL REQUIREMENTS

To make the best use of this new window, the first thing required is to collect the maximum amount of radiation; the second, to achieve sharpness of definition, or "resolution," which depends upon accurately measuring the angles at which the radiations arrive. With radio waves, which are about 1,000,000 times longer than light-rays, this last is difficult. A radio telescope which could rival the 200-inch (82.24 metre) optical telescope on Mount Palomar would need an aerial several thousand miles long.

The great steerable radio telescope at Jodrell Bank, with its 250-foot (76.2 metre) bowl has a collecting area 200 times that of the Palomar instrument. When operating on short radio waves, it covers a narrow cone of only about one-tenth of a degree; yet, it cannot bring remote radio sources into sharp focus.

Tackling the problem from a different angle, astronomers at the Cavendish Laboratory, Cambridge, headed by Martin Ryle, developed a novel type of instrument called the Interferometer. The first was built in 1948, and another, much larger, in 1952. Now, financed by Mullard Ltd., of Torrington Place, London, W.C.1, and the Department of Scientific and Industrial Research, two new and improved models are to come into operation this autumn.

Running on railway lines, the interferometer with its moving aerial is here seen under construction at the Mullard Radio Astronomy Observatory at Cambridge, England. The steelwork is complete, and part of the dipole assembly is in place. The tracks cover 1,000 ft. and the length of the aerial is 190 ft.

RESOLVING POWER

The resolving power of an aerial depends upon the "interference" of the radio waves received at its edges. If two incoming waves are exactly in phase they reinforce each other and give a double-strength signal; if not, they interfere with each other and the signal is weakened.

Up to certain limits, the longer the aerial the greater the interference. So the idea arose of splitting the aerial into halves, moving them a considerable distance apart and then combining the signals which each half received. In this way it would be possible to increase the resolving power far beyond what is possible with a single aerial, while keeping the collecting power the same.

One of the two new instruments is an interferometer which works on a wave-length of 1.7 metres. It has a fixed east-west aerial 1,450 feet (442 metres) long and 65 feet (19.8 metres) wide, and another east-west aerial 190 feet (57.9 metres) long and 65 feet (19.8 metres) wide which moves along a 1,000-foot (304.8 metre) stretch of north-south railway line.

COLLECTING AREA

Both aerial networks are supported on the rotatable arms of huge tubular steel frames. The collecting area is about 190,000 square feet (17,651.6 square metres), which makes it more sensitive than any previous radio telescope. Directions of incoming radio waves can be measured accurately to within a few

(Continued on Page 13)

IRC AUSTRALIA

LOUDNESS CONTROL

is designed to replace your existing volume control . . . and to provide correct high and low frequency compensation as volume is reduced.

(Patent Applied for No. N11262)

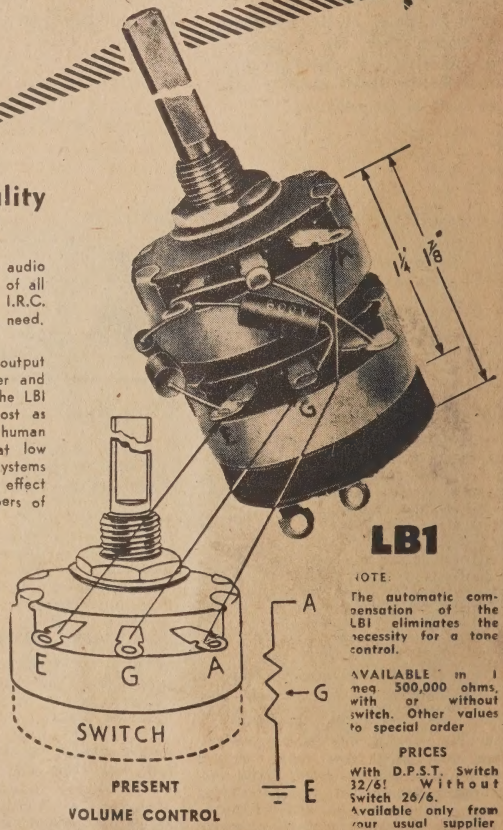
Maintains the correct tonal quality right down to whisper level!

For many years there has been a need for a volume contol in audio systems which would automatically keep the proper balance of all frequencies within the audio range at ANY listening level. I.R.C. has developed such a control, known as the LBI, to meet this need.

With the loudness control it is possible to reduce the output volume of any good or average audio system to a whisper and still be able to hear every tone with perfect balance, as the LBI provides gradually increasing high and low frequency boost as the volume is reduced to offset the deficiencies of the human ear, which is insensitive to high and low frequencies at low volume. This accounts for the reason why many audio systems are operated at such high levels to give the best listening effect and in this process they become annoying to other members of the household and neighbours.

The I.R.C. new loudness control consists of two separate volume controls operated from a single shaft of standard size and used with a combination of capacitors and resistors which are already wired. The unit will replace any volume control by transposing 3 simple connections, as indicated by the illustration at right. Can be fitted without experience.

Contact your usual supplier for illustrated literature



LB1

NOTE:

The automatic compensation of the LBI eliminates the necessity for a tone control.

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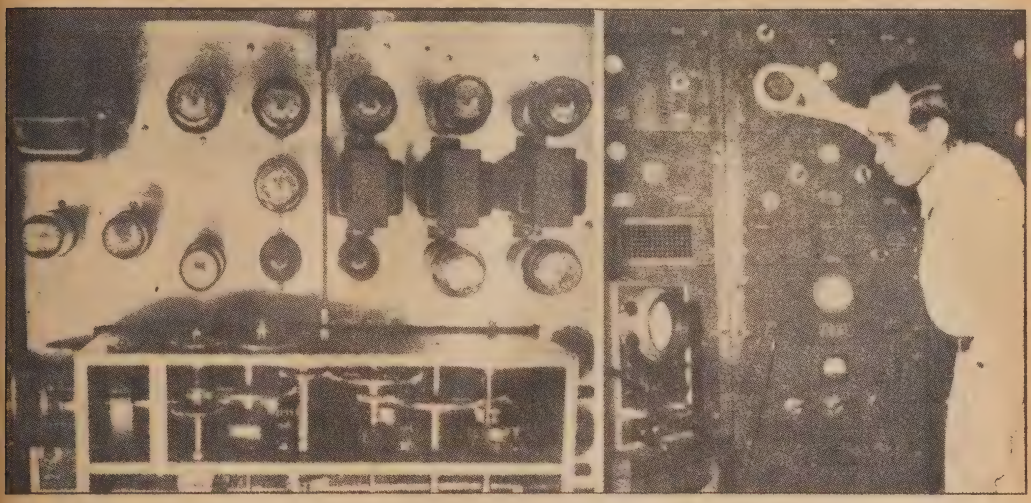
THE HISTORY OF STANDARD PITCH



Left: Seconds-pulse generator and time-interval selector at station WWV. This serves as the motivating unit to remove (and then return) the audiofrequency tones—standard musical pitch at 440 c/s and a 600-c/s tone—from the broadcast signal for periods of 1/25 sec. once each second. During the 1/25 sec. interval a short train of 1000-c/s oscillations is used to provide a seconds "tick." The precision is electronically controlled. Right: Audio frequency racks used for generating standard musical pitch, 440 c/s (A above middle C), at station WWV. The racks shown also generate a 600-c/s tone, and each of the two tones is broadcast for 3 min. in alternate 5 min. intervals. The engineer is here adjusting the phase relationships of the audio oscillations generated by the different racks to keep them in accurate synchronism.

The necessity for a standard of musical pitch extends today far beyond the musical world, for many electronic and even measuring systems depend for their operation on frequencies within the audible range. In addition to information about the WWV time station, this article outlines some of the earlier steps in the evolution of standard pitch.

ONE of the lesser known services of the National Bureau of Standards is the broadcasting of a musical tone of standard pitch—middle "A" at 440 cycles per second—over its shortwave stations WWV (Beltsville, Md.) and WWVH (Maui, Hawaii). These broadcasts make standard pitch available day and night throughout the United States and over much of the world. Because a shortwave receiver is all that is needed, easy access to standard pitch is thus provided for piano tuners and amateur and professional musicians as well as for makers of musical instruments.

USE OF TONES

A 600-c/s tone is also broadcast. This, together with the 440-c/s tone, is used by scientists, electronics engineers, and manufacturers in the measurement of short intervals of time and for calibrating instruments and devices that operate in the audio and ultrasonic frequency ranges. Both the 440- and the 600-c/s tones are obtained from an electronic, crystal-controlled oscillator and are accurate, as transmitted, to better than 1 part in 100,000,000.

The two frequencies are broadcast alternately, starting with 600 c/s on the hour for 3 min, interrupted 2 min, followed by 440 c/s for 3 min and interrupted 2 min. Each 10-min period is the same except that WWV is off the air for 4 min beginning at 45 min after each hour; and WWVH is silent for a 34-min period each day, beginning at 1900 Universal Time (9 a.m. in Hawaii).

BROADCAST FREQUENCIES

To provide greater assurance of reliable reception, transmissions from the NBS stations are made simultaneously on several standard broadcast frequencies. WWV broadcasts on 2.5, 5, 10, 15, 20, and 25 Mc (megacycles per second) and WWVH broadcasts on 5, 10 and 15 Mc.

In the U.S.A., A = 440 c/s has been accepted as standard pitch since 1925. Initially, this value was agreed upon by the Music Industries Chamber of Commerce as a useful compromise among the various pitches chosen arbitrarily by different musical groups. In 1936 the same pitch standard was adopted by the American Standards Association, giving it the status of an industrial standard.

Three years later the International Federation of National Standards Associations (ISA) sponsored a conference in London, France, Germany, Great Britain, Holland and Italy sent delegates and the United States and Switzerland sent official messages. Six of the seven countries independently proposed A = 440 as the standard and the conference adopted it unanimously. The same standard was again endorsed by the International Organisation for Standardisation (ISO) in 1953; and was accepted as an ISO Recommendation at Stockholm in 1955.

The National Bureau of Standards maintains the A = 440 standard as the one on which general agreement has been reached. The musical merits of any particular standard are, of course, outside its province.

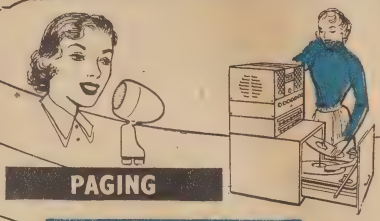
EARLIER STANDARDS

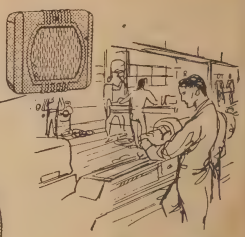
Previous standards of pitch were defined in terms of the frequency of a particular tuning fork or bar, or the length of a specified vibrating air column (organ pipe). Because the sound frequencies generated by these devices vary with the surrounding temperature, it is necessary to specify the temperature at which comparisons with these standards should be made.

In 1859 the "Diapason Normal" was defined in terms of a standard tuning fork deposited by the French Government at the Paris Conservatory of Music. The vibration frequency of this

FOREMOST IN SOUND

ADDRESS, RADIO AND RECORD PLAYING SYSTEMS





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fork was stated to be 435 c/s when measured at the then standard laboratory temperature of 15 deg. C. When R. Koenig (1880) made a careful determination of the frequency, it proved to be 435.45 c/s at 15 deg. C. and to have a thermal coefficient of —0.0486 c/s per degree Centigrade. Thus the fork would really have the defined standard frequency at slightly over 24 deg. C.

An international congress in Vienna in 1891 adopted the French definition of the Diapason Normal, and it acquired the name of "International Pitch." Great Britain and the United States apparently did not attend this meeting, though A = 435 was used as a standard by a number of musical groups and instrument makers in this country after its adoption by the Vienna congress.

In many places the pitch standards in actual use were strongly influenced by the way large, permanently installed pipe organs were tuned. Yet, of all the mechanical devices used to generate musical frequencies, the vibrating air column of the pipe organ is the most sensitive to changes in temperature. Their frequency would therefore depend on what the temperature happened to be when they were adjusted to conform to the standard fork in the Conservatory at Paris. Since the advent of better heating systems and air conditioning, the temperature at which most musical instruments are used today is better represented by 20 deg C. (68 deg. F.) than by the temperature of 15 deg. C. (59 deg. F.) associated with the Diapason Normal. Luckily, an organ pipe tuned to A = 435 at 15 deg. C. will actually be tuned almost exactly to A = 440 at 20 deg C.

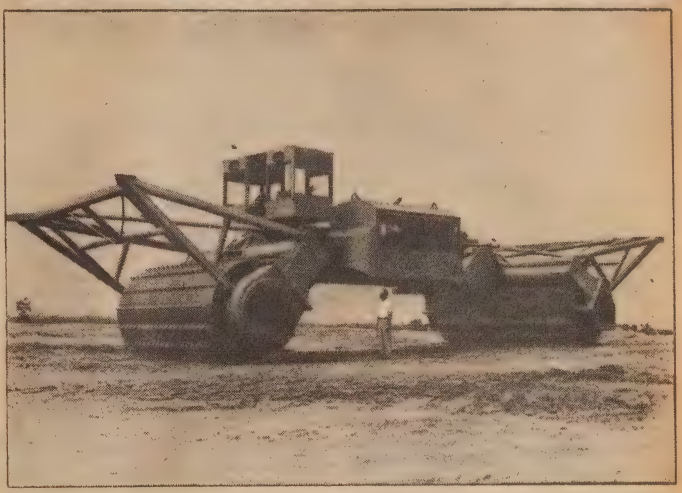
ADVANTAGES

From a technical point of view, the present standard of musical pitch as maintained by the Bureau, has the advantage that it is free from the vagaries of the material objects (tuning forks, organ pipes) that embodied past standards. Thanks to modern electronic techniques for generating and stabilising oscillations a tone is produced that for all practical purposes is independent of the temperature of the surroundings.

This would apply, of course, to any musical frequency that might be chosen. It happens, however, that the 440-c/s frequency stands in a very simple relation to other frequency standards maintained by the Bureau and can, therefore, be produced with a minimum of additional equipment. A tone of 435-c/s, for example, would require a somewhat more complicated technical arrangement.

In changing over to Standard Pitch, little or no alteration is necessary in adjusting instruments tuned to the older standard. Instruments tuned by string tension and the open vibrating air columns of pipe organs present no problems at all. Woodwinds can be corrected partly by the tuning adjustment of the instrument and partly by the breath control of the player; and changes required in the reed stops of the organ are within the range of the instrument's tuning adjustments.

BRUTAL MACHINE SMASHES JUNGLE



One of the most brutal machines ever devised is this jungle smasher, designed to clean up the face of the earth. It can rip huge trees up by the roots, slap them to the ground, and literally smash them to splinters. Axe-like cleats on steel rollers convert trees and underbrush into a mat-like carpet ready for burning or other disposal. It weighs 140 tons and can clear an acre of land in 15 minutes. It is 74 feet long, 22 feet wide, and 19 feet high, and has a capacity of 1,000 gallons. Its 9 foot rollers have 300 cleats each. Pitted against a giant-sized tree, the front roller climbs the trunk until it has enough leverage to push it over. The axe-like teeth then tear it to pieces.

SPACED RADIO AERIAL TO DETECT STARS

(Continued from page 9)

minutes of arc, or less than one minute from a strong radio source. It is specially suited for studying radio sources in other galaxies which may be millions of light-years away.

VERY LONG AERIAL

The other instrument, which is better adapted for studying the Milky Way, works on a band of 7.9 metres. It has a fixed east-west aerial 3,200 feet (975.36 metres) long and a movable aerial which runs along a 1,700-foot (518.16) metre track. It looks quite different from the first apparatus. Its immensely long fixed aerial is supported by a row of steel frames in the shape of open triangles with rods projecting from their bases at an angle of 45 degrees to the horizontal. This "pencil beam" system, as it is called, has a collecting area of 200,000 square feet (18,766.4 square metres) which is about four times that of the Jodrell Bank telescope.

With radio telescopes, in-coming signals are usually focused, amplified and then recorded in ink on chart paper. Instruments like that at Jodrell Bank show, perhaps, a single peak wave as the radio source crosses the centre of the bowl; but the two separate aerials of an interferometer show a complex system of waves as the two sets of signals alternately weaken and reinforce each other. This gives a great deal of information. By measuring the comparative heights of the crests and the intervals between successive peaks, and so on, together with the spacings of the aerials, it is possible to pin-point radio sources more accurately and to measure their areas.

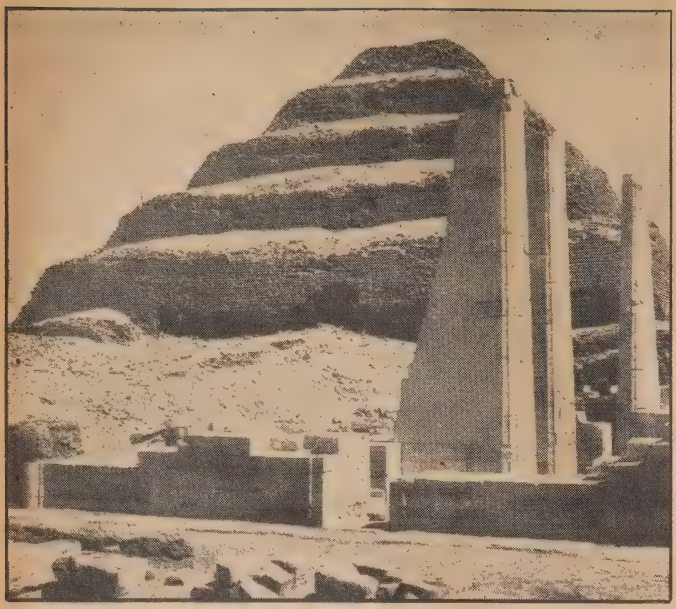
The interferometer set up in 1948 located a radio source no less than 200 million light-years distant with such precision that the Palomar telescope was able to pick it up. It proved to be two galaxies in collision.

The instrument, built in 1952, has detected about 2,000 radio stars, only about 10 of which have so far been identified visually.

QUICK WAVE-CHANGE

Each type of radio telescope has its particular uses. The one at Jodrell Bank can change its operative wave-length comparatively quickly and follow indefinitely a source from which many kinds of radio waves are coming. The Cambridge instruments work on fixed wave-lengths but they can pin-point and measure with greater accuracy.

Many astronomical problems await solution. Ryle and his colleagues maintain that radio stars are closer together at extreme distances, which conflicts with certain views about the origin and history of the universe. The new instruments which are about to come into operation will probably settle the matter.



The great Step Pyramid of Egypt gives some idea of the painstaking labour which went into the construction of these huge structures.

Master Builders Of Early History

From the time man first inhabited the earth he made every effort to avoid work. Thus to avoid work is a natural phenomenon and, carried out with a reasonable amount of common sense, is a worthy objective.

by Calvin Walters

IT is self-evident that all of us have to do a certain amount of work and this is governed by the amount of money we have or the amount we can spare.

Thus some people avoid work by having somebody else to do it for them. At this stage you are at the top and you acquire the term "the Boss." You, supposedly, have no worries except those brought about trying to induce those who work for you to keep working. Thus you do not get aching muscles and bones but get, instead ulcers, coronary occlusions, nervous breakdowns and insanity. You can play golf three days per week and weekends.

INDUSTRIAL RELATIONS

Coming down the scale there are those who work for the Boss and, because of their skill are adequately recompensed (according to the Boss). At this stage you are called an "Executive." Your job is to organise the other workers in such a way that they will always earn enough money for the Boss to enable him to pay you a bit more than the others. In trying to do this you also get only ulcers and so forth.

But you, in a limited sense, can get enough to become a little Boss and employ somebody to mow your lawns, paint the house and do other odd jobs around the place. You can play golf on one week day and weekends.

Lower down the scale there are those who work for the Boss. These do all the work and are divided into skilled workers and labourers.

The skilled workers get a little less money than the Executive and are thereby enabled to buy petrol lawn mowers and a few other labour-saving devices which enable them to avoid hard work at home and to play golf on one day at the weekend. But he has to paint his house himself.

The labourers are the last on the list. These get more money than anybody else because they get paid for overtime. Some of them do overtime to do the work they didn't do during ordinary time. Thus they are able to save enough to buy a motor car, a television set, petrol lawn mower, vacuum cleaner and automatic washing-machine and can get away for weekends. They have no ulcers and so forth.

Then there are the faithful labourers who work hard during the day, get their work done and therefore get no overtime. They can save nothing, have to push a mower, boil the clothes in a copper, borrow a deposit on lounge suite. They can listen to the radio, bought on time payment and, maybe, watch the local football match on Saturday afternoon. They get nervous breakdowns.

DIVISION OF LABOR

Right through the ages this division of labour has existed. A continual battle of wits to avoid work has inspired man to find machines to work for him. As nobody wants to work hard, machines which would work gradually replaced men who wouldn't.

In very early times little was understood of the principles of mechanics. Primitive man did not know that there are only three Mechanical Powers, namely, the lever, the inclined plane and the pulley. These are called the Primary Powers. There are three Secondary Powers, derived from these, namely, the Wheel and Axle (derived from the lever), the Wedge and the Screw (derived from the inclined plane).

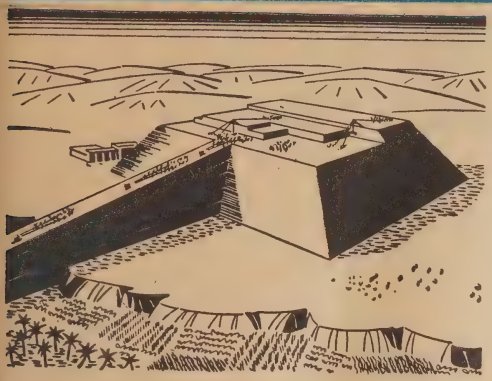
Every piece of mechanism yet devised by man is based on these Primary and Secondary Powers.

The lever is merely an inflexible rod supported at some point along its length by a support called a fulcrum. When in use it has a resistance to overcome at one end and a power to overcome it at the other end.

Common examples of the lever are seesaws, spades for raising earth, scissors and pincers, crowbars, oars for boat-rowing, wheelbarrows, nutcrackers, fishing rods, whips, umbrellas and coal and sugar tongs. There are levers in the human body—for example, the biceps muscle and forearm, the deltoid muscle and shoulder.

There are many combinations of levers used in machinery, and the wheel and axle is a secondary form of it. When used for raising heavy weights the weight to be lifted is usually attached to a rope wound around the axle. The lifting power is applied either to a rope wound around the periphery of the wheel or to a handle attached at right angles to the latter. An ordinary winch is an example. The capstan and windlass are also examples.

SIMPLE MECHANICS IN ANCIENT ENGINEERING



Building the pyramids involved hauling thousands of huge blocks of stone up a long specially constructed causeway which was afterwards removed.

Most of the saws used by the Egyptians were made of bronze, but there is evidence that their drills were fitted with jewelled points.

In the primary lever it is well known that the closer the fulcrum to the weight to be lifted the greater the force that can be applied to the other end and therefore the greater the weight that can be lifted.

In the wheel and axle the larger the wheel for a given size axle the greater the weight that can be lifted by a rope wound around the axle. In machines this principle is applied by having an axle of fixed diameter and having wheels of different sizes fixed thereon. Thus different ratios can be used for varying weights. Combinations of toothed wheels or cog wheels are also examples of the lever.

The second Primary Power is the Inclined Plane. It is well known that a man can pull up an incline a weight which he cannot lift. If he can roll the weight up the inclined plane the task is yet easier, for he has no need to overcome the effect of friction on the surface of the plane. Calculations show that a force which would just lift a weight of 300lb vertically would also hold a weight of 780lb in position on an inclined plane of 5 (height) in 13 (sloping length).

There are various modifications of the inclined plane in the form of knives, chisels, axes, wedges and so on. The two latter are Secondary Powers. In the wedge initial pressure is applied to the back of the wedge, and the resulting pressure is transferred to the two sloping surfaces in such a way as to lift objects or split asunder. This is evident in the action of chisels, knives and planes. Nails, plugs, needles and other sharp pointed instruments are familiar examples.

THE PULLEY

The power of a wedge can be seen in those used for raising a ship in a dry dock. The term "firmly wedged into position" explains a lot.

The screw, a most important element in all machines, is a modification of the inclined plane. This will be evident to all. Enormous power can be developed with correctly designed screws. It will at once be seen that the thread of a screw is an inclined plane but is of no use unless it is coupled with its "pair." A familiar example is the bolt and nut. This is a complete elemental pair.

When one element of the pair is fixed and a rotating force applied to the other element, work can be done. A common example of this is the "jack" used to raise motor cars and other vehicles. By varying the "pitch" (distance between the threads) and the slope of the thread, a rotary force acting on it can lift enormous weights such as bridges, railway locomotives, brick buildings. In fact there appear no limits to the weights which can be lifted. The force which can be generated by a screw can be witnessed in the erection of steel structures such as great bridges. It is so great that such structures are held together by bolts and nuts so tightly that there is little chance of them moving.

THE WEDGE

The last Mechanical Power with which we have to deal is the Pulley.

Everyone knows what a pulley is. If not, then it is merely a wheel with a groove cut all round its circumference and movable on an axis.

Sometimes a pulley is called a sheave and is often suspended in a casing or block where it becomes the familiar block through which and over the pulley is passed a cord or chain called the tackle. The whole assembly is then called a block and tackle.

PULLEY APPLICATIONS

In machinery pulleys are used to change the direction of rotation by means of belts, to transfer an applied force in another and more convenient direction and so on. By various combinations of a number of pulleys of the same size or different sizes an applied force can be used to lift enormous weights. The familiar block and tackle is a good example of this. The crane used to lift locomotives and loads of building material is a combination of the lever and pulley.

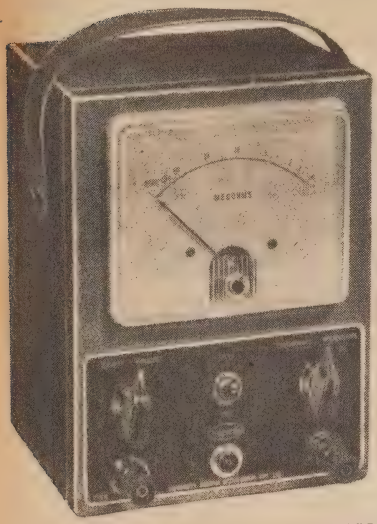
It may come as a surprise to many to learn that the most intricate machine yet invented is a mere combination of the three primary mechanical powers dealt with above.

Early man no doubt made use of these principles in a primitive manner. For instance, he used cutting stones which were nothing more or less than stones ground to wedge form. These were used for cutting his food and so on.

He later learnt to attach a handle to the wedge and so made an axe which he used for obtaining his food and for defence.

Vertical obelisks were first hauled up inclined planes, and over a sand-filled hole in a stone platform. When the sand was removed, the base of the obelisk settled into place.

3 UNIVERSITY INSTRUMENTS THAT GIVE YEARS OF ACCURACY AND SERVICE

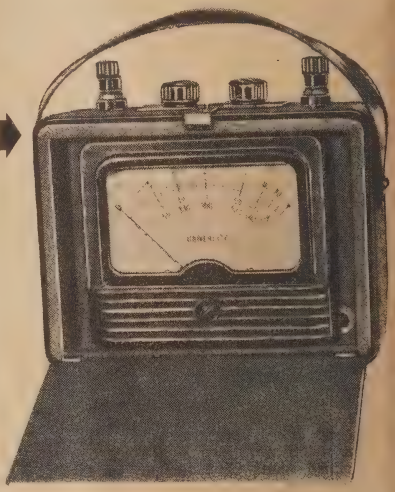


MEGOHM METER

This instrument is ideal for television purposes and other applications where high resistance values need to be checked. Its major uses are for checking resistance values, leakage paths and capacitor testing. In many cases it will take the place of a Megger and as it operates from power mains it leaves both hands free for other work. It is designed to operate from 240 volts AC and it is small and compact. Two ranges are provided of 0-100 megohms and 0-1,000 megohms. Both of these ranges are at a test potential of 1,000 volts. The available energy is extremely small and therefore the instrument is not dangerous or lethal. Special terminals are provided which enables standard test leads to be plugged in or wires or components to be connected directly to the instrument.

MODEL D10D

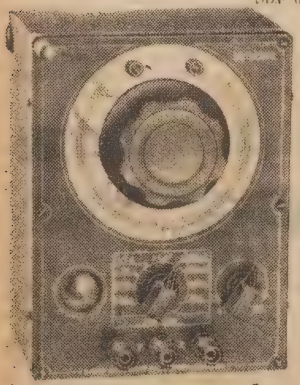
MODEL EXT/2



LOW AND MEDIUM RANGE OHMETER

This portable and self contained instrument which covers resistance readings in several ranges has many applications in the Electrical Radio and Industrial fields. Small in size, this instrument uses a 4 inch square meter and is housed in a hard moulded rubber case which enables it to take heavy shocks and be unbreakable. The meter is protected by a metal flap which closes when the instrument is not in use. Ranges are:—

0-20 ohms (2 ohms centre)
0-500 ohms (20 ohms centre)
0-5000 ohms (200 ohms centre)
Size 6¾" x 3".



MODEL UBA

RESISTANCE CAPACITY TESTER. MODEL UBA

With the complex circuits in TV receivers employing many capacitors and many resistors, this special instrument provides a good standard of accuracy together with ease of handling. It covers an extensive range of resistance measurements from .1 ohm to 10 megohms and capacity measurements from 10 micro-microfarads to 10 microfarads. It is accurate and sensitive and is overload proof. A calibration system is incorporated to enable rapid checking of the apparatus at any instant, and internal standards are adjusted to an accuracy of plus or minus 1 p.c.

UNIVERSITY GRAHAM

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The lever took the form of a stout stick which was used for prising up rocks under which were found articles of food, such as grubs, snakes, lizards, and so on. He may even have rolled logs into position with his lever, gaining the idea of rolling motion which eventually led him to the pulley and wheel.

Man advanced because of increasing knowledge, not necessarily because of increasing intelligence. Early man was quite as intelligent as we are today but he did not have the knowledge we now have of how to use natural principles.

It is remarkable, therefore, that he was able to construct some of the most remarkable edifices ever known.

The Great Pyramid of Cheops in Egypt is one of these. Built about six thousand years ago it still stands the largest single structure ever built by human hands. It is a prime example of the adaptation of the inclined plane to building purposes.

MATERIAL USED

Two million limestone and granite blocks were used to build a structure 750ft square and 500ft high. The average weight of the stones is 2½ tons but the basement stones weigh up to 57 tons. The total weight of the stones is five million seven hundred and fifty thousand tons. Over one hundred thousand men were engaged on its construction.

Most of the stone came from quarries a few miles away on the other side of the River Nile. The polished granite used for the outer casing came from quarries several hundred miles up the river.

During periods when the valley was flooded the stones were floated across on barges to the site and then hauled by the labour of one hundred thousand men up a specially prepared inclined plane, 60ft wide and three-quarters of a mile long. This incline was covered with polished stone in order to reduce friction. It took 10 years to build this inclined causeway and this alone was a formidable task.

The causeway was 48ft at its highest part which made the incline fairly steep, needing a vast number of men to haul the blocks into position.

The base of the pyramid is made of blocks about 4ft long, 4ft wide and 2½ft thick, carefully cut to rectangular shape and fitted together.

OUTER COVERING

A second layer was placed on this with the outer blocks set inwards about 1ft 6in. The next layers were set inwards a like distance until there were 200 layers, gradually reducing in area to the required height of about 500ft and giving a stepped appearance.

The outer face of the pyramid was then covered with a casing of polished granite. These casing stones were not rectilinear but had one sloping side so that the finished pyramid had a smooth, sloping surface.

What implements were used for cutting and shaping the stones and what machines were used to lift the stones into position?

The great historian Herodotus speaking of the construction mentions that "after laying the stones for the base, they raised the remaining stones to their places by means of machines formed of short wooden planks" . . . He mentions that there was a machine on each step so that there must have been 200 machines each used to advance the block of stone from step to step.

STONE RAISING METHOD

It is thought that these machines consisted of simple wooden frames in the form of an A with the feet fixed so that the machine stood at an angle of 45 degrees and leaning outwards. A rope passed over the top would, with a horizontal pull at the top, impart a vertical movement to a block suspended from the top by another rope.

The inclined plane was raised in height to the top of each step up to the 200 foot high stage, so that it was possible for about half the work, to haul the stones directly to the site. At this height the slope of the inclined plane would be one in ten, which is not excessively steep for hauling by thousands of men. To support this theory is also the fact that the heaviest blocks are found at the 200 foot level. From this level the machines or crude cranes took over.

When the required height had been reached the machines were used to haul the polished granite facing into position. This was done from the top down so that each machine must have been removed as the outer surface was completed at each step.

As to the tools used to cut and shape the stone much is told by marks on the stones themselves. These marks clearly show that both straight and circular saws were used. Cuts on the sides of the larger stones show that some of the straight saws were at least eight feet long.

Green stains on the sides of the stones indicate that the saws were made of bronze and that the blades varied in thickness from 3/100 of an inch to 1/5th inch.

The holes in the stones were made by tubular drills, some of which had jewelled cutting points. These drills varied from ¼ inch to four inches in diameter. The larger drills were used in the soft limestone, and, therefore, most likely had no jewelled points, while the smaller drills were used in the granite and needed the jewelled points.

Many of the stones for the core and all those for the outer casing were prefabricated for placing in particular positions. Each block already in position was marked with lines to show where the remaining blocks had to go. Thus the art of prefabrication was known to the architect of that time.

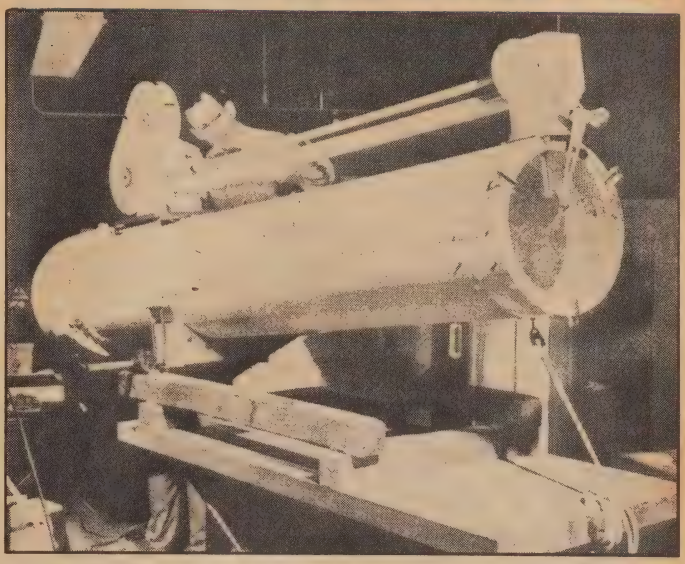
HIGH ACCURACY

These prefabricated blocks were cut and shaped on the ground and tested for accuracy before being pulled into position.

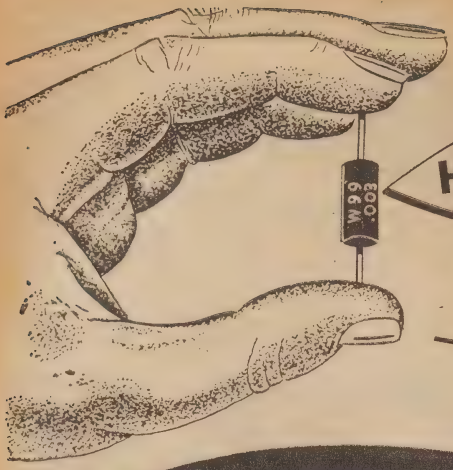
So accurate was the work that the average error in the base of the pyramid is less than one ten thousandth of the side in squareness and level. The outer casing covers 13 acres in area and is so well fitted that most of the seams are almost invisible and have a width

(Continued on Page 83)

MOVIE CAMERA TO SHOOT THE SUN



This movie camera has been designed to shoot pictures of the sun through a specially constructed balloon-borne telescope on which it is mounted. The telescope, six inches in diameter with a 12-inch mirror, is expected to eliminate hazy pictures of earth-manned telescopes by operating at altitudes of 80,000ft or better. It is operated by U.S. Naval research.



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Type W99 covers the range —

.004uF to .04uF 200 Volts Wkg.
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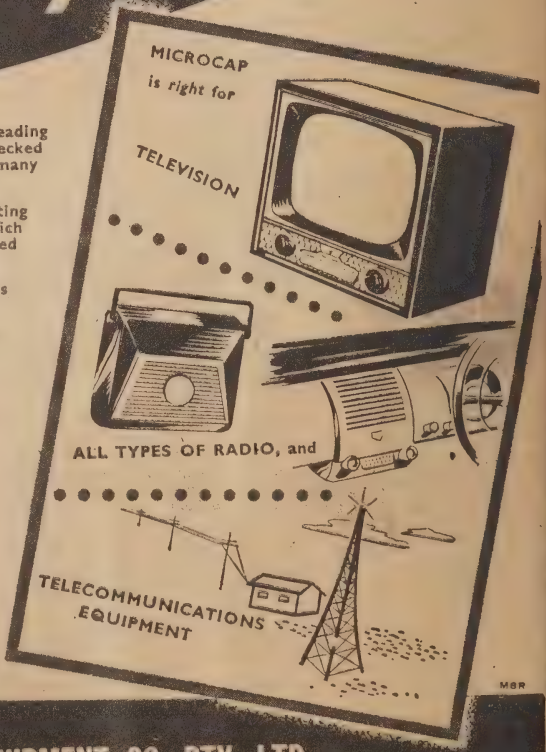
This range is extended to 2.OuF 200 and 300 Volts Wkg. and 1.OuF 400 Volts Wkg. in Type W48, which also have the valuable "self-healing" feature.



Manufactured in Australia under licence from A. H. Hunt (Capacitors) Ltd., England, by

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Technical Review

COSTS CUT BY THREE DIMENSIONAL PRINTED WIRING

A summary from a recent "Electronics" article, the following shows how a three dimensional printed wiring technique can be used to speed production and ensure uniformity of memory circuits for electronic computors. The technique holds great promise in that it can be extended to permit cheap manufacture of toroids. It may also find application in many tedious production wiring jobs.

EACH standard 64 x 64 modulator memory plane for a computer requires one man-day to assemble, because four insulated wires must be individually threaded through each of 4,096 ferrite cores.

Three-dimensional printed wiring now appears to be a solution to problems of assembly time and core damage. Collimated light is the basis of the new technique which produces, in a single exposure, a latent image of the complete wiring pattern for a memory plane.

INTIMATE CONTACT

With ordinary light, the negative mask must be in intimate contact with the photosensitised surface, as in Figure 3A. With collimated (parallel) light, the mask and the photosensitive surface can be separated as in Figure 3B. If a beam of parallel light is directed through an aperture mask at an angle to a photo sensitive panel as in Figures 3C and 3D the projected image follows the contour of the panel. The image of any aperture can thus be projected with fidelity on to any surface, regardless of its irregularity.

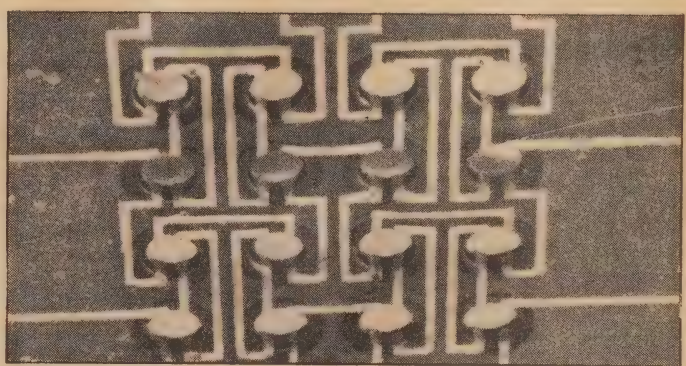


Figure 1 (Above) Prototype 4x4 memory plane produced by print-wired technique, showing how etched conductors on one side of board to go right through holes in embedded ferrite memory cores to join wiring pattern on other side of board. Fig 2 (Left) Single lamp set-up illustrates how collimated light projects wiring pattern through ferrite core.

Before this technique could be applied to the production of print-wired memory planes, the intricate wiring pattern of conventional wired planes had to be rearranged.

Four wires must pass through each core — X and Y co-ordinate selection windings, a sense winding for reading out stored information and a digit-plane

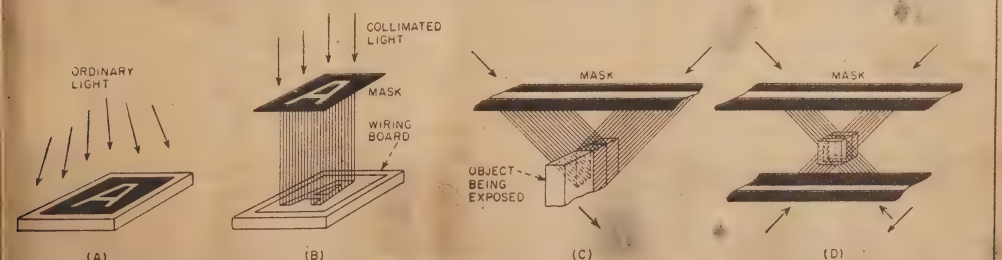


Figure 3. Divergent nature of ordinary light makes it necessary to use contact printing, whereas use of parallel or collimated light permits projecting image without change in size, for exposing shaped objects.

FERRIS TV

PORTABLE TV RECEIVER MODEL P17

THE FOLLOWING IS A COPY OF AN ARTICLE WHICH APPEARED IN A RECENT ISSUE OF THE ELECTRICAL WEEKLY, COVERING OUR NEW PORTABLE TV RECEIVER.

DESCRIPTION: A 17" portable TV receiver with retractable carrying handle, having 16 valves, three crystal diodes and Type 17HP4B aluminised picture tube.

FEATURES: Separate portable power supplies for 12V battery operation and 220V to 250V. 50 C/s. Vibrator supply uses two standard radio-type vibrator cartridges; total drain including receiver valve heaters—10A at 12V DC. Valves: 6CW7, three 6BL8, three 6CB6, 6AV6, 6AQ5 12BH7, 12AU7, 6BQ6. 6AX4, 1B3G and two 6N3.

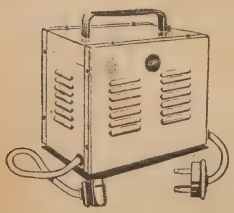
AERIAL INPUT 300: cascode turret tuner receives 10 channels; parallel valve heaters; twin 5¾" speakers (one each side of cabinet); sound output 3W max. IF's 36MC/s and 30.5MC/s. Extension speaker connection provided.

TOP CONTROLS: channel selector and fine tuning; contrast and volume; horiz. hold, vertical hold and brightness Preset controls; height and vertical linearity.

All high-voltage points protected. All valves accessible on removal of safety back. Chassis may be removed without disturbing speakers, picture tube or yoke assembly. Clear curved armor-plate safety glass; picture tube unmasked. AGC may be removed from "front end" by simple accessible adjustment for better results in some fringe areas.

All metal cabinet finished in baked enamel; colors, two tone grey and two-tone blue and grey. Dimensions: 14" high and 17" wide and 18" deep. Nett weight 49 lb Packed weight 59lb.

(Similar receivers fitted with field strength meter for survey work available to order; price on request). Receiver and vibrator power supplies for use with 32V lighting plant to order.



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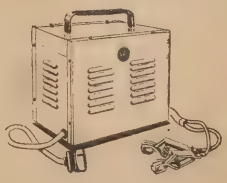

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FERRIS PORTABLE TV RECEIVER 179 GNS. TROLLEY £7/19/6

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Please send me information about your—

★ Portable TV Set
★ 240V Unit
★ 12 or 32V Unit.

Name .....

Address RH11/57

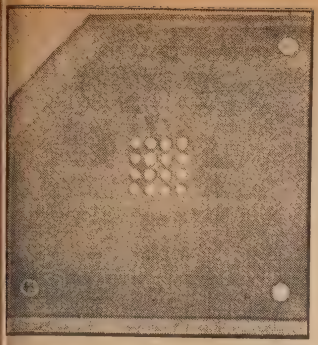

Figure 4. Holes are punched in paper-based phenolic laminate for ferrite cores and registration pins.—Step 1

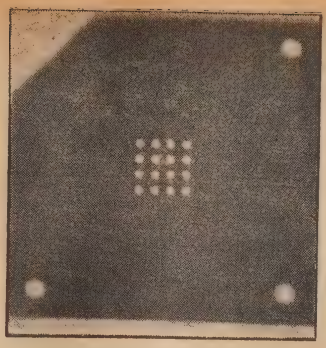

Figure 5. Doughnut-shaped cores are dropped into holes and entire board coated with plastic to anchor them — Step 2

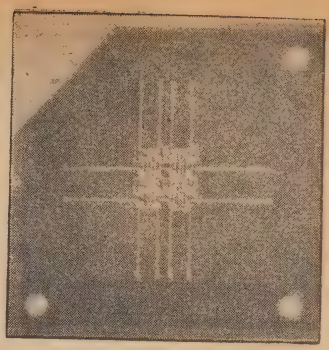

Figure 6. Complete wiring panel ready for external connections after completion of photo-etching process

winding to determine the information to be stored. The co-ordinate selection windings were planned as shown in Figure 8A. A given core is selected by the coincidence of two current pulses each one-half of the minimum value required for switching.

A second major problem was that of producing a pair of accurate masks which could be held in close registration to connect the front and back surface wiring patterns with four connecting paths through the 0.050-inch hole in each of the cores. Although the cost was high, a set of satisfactory masks was prepared by photo-engraving methods. Further study resulted in the development of a selective masking technique capable of economically producing masks with a line-centre position accuracy of plus or minus 0.001 in from an outside reference line.

ELECTIVE MASKING

Selective masking is based on the fact that it is possible to rule a single pair of parallel lines to great accuracy. These two lines can be used to form appropriate segments of a wiring pattern by repeated exposures on a step and repeat table.

Before exposure, the entire memory plane assembly must be coated with copper. The board is first covered with a clear plastic solution which, when set anchors the cores firmly in the holes and covers any gaps. The plastic provides a smooth unbroken surface on which to deposit copper chemically. This initial layer of copper adheres firmly to the plastic as a highly conductive base on which to electroplate another layer approx 0.002-inches thick. Conventional photo-etching techniques then begin.

At the present stage of development 16-core (4 x 4) planes have been successfully produced to verify and refine the method. These planes have been the electrical equivalent of conventionally wired planes of the same size. Masks are now being prepared for 16 x 16 arrays. The practicability of the method has been demonstrated. Its appeal rests on the fact that it is, even on a laboratory basis, about 20 times faster than current production methods for memory arrays.

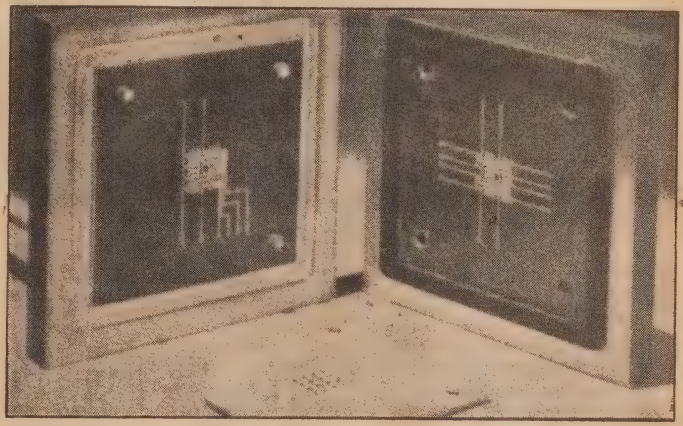

Figure 7. Opened masks used to expose resist to produce wiring for prototype 16-core memory plane. Three positioning pegs on left hand mask holder go through register holes in memory plane board and in other mask, to provide required high precision of alignment for printing wiring pattern simultaneously through cores and on both sides of the board.

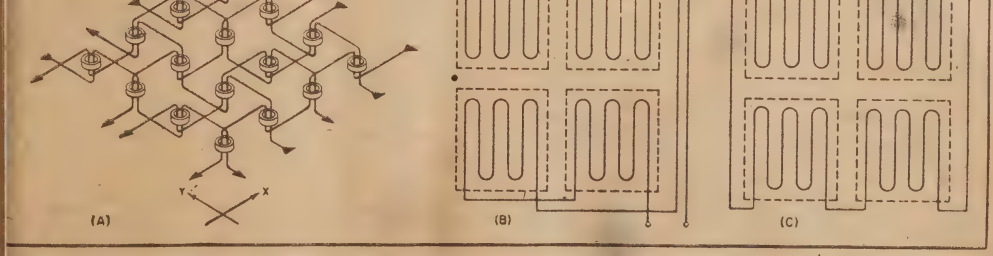

Figure 8. Rearrangement of co-ordinate-selection windings of memory plane as at A, quadrant-cancelling sense winding as at B and quadrant-cancelling inhibit winding as at C eliminates crossovers to permit printing four wires through each core

There's something special about this record . . .

Just an ordinary record to look at; very much like any other you might say. Quite right, of course, in appearance it is like any other. What makes it particularly special—where it came from and what it's played on. If it came from Modular and it's played on Hi-Fi equipment to the standard that Modular sells—it's a very special record. You see Modular do not sell just any record: they sell only records of serious music . . . furthermore, of all the serious music released only approximately one record in ten is recommended as being up to Modular's standard, both musically and technically. You see what we are getting at—only by such stringent specialization is it possible to ensure that we always have sufficient stocks of the right records.

Now to another important point: Only through the wonders of High Fidelity is it possible to achieve the utmost from any record.

We at Modular are High Fidelity experts and will be only too willing to answer any of your Hi-Fi questions. If you wish to buy a Hi-Fi player we can recommend the best set to suit your purposes and then again if you wish to build your own set we can supply the best components and assist you with technical advice and even help you in the construction—just another of the many helpful services which Modular Electronics offers.

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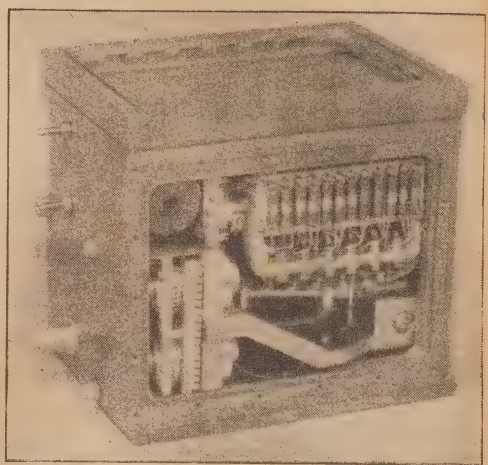
—just down from the Seaforth Post Office.

LIQUID COOLING FOR AN AIRBORNE TRANSMITTER

From a recent issue of "Electronics" comes information on the design of a compact high power amplifier for high performance aircraft. It employs six parallel output valves and cooling is by immersion in silicone fluid. Total volume of assembly is 500 cubic inches.



Complete amplifier in housing. Fluid expansion chamber is at top, output valves at lower left with fluid circulating pump and ducting across bottom.

At present, airborne HF radio transmitters are limited to about 100 watts maximum carrier power output, mainly because of excessive size and weight of higher power output transmitters.

In supersonic aircraft, HF aerials are becoming physically shorter, with tail cap or wing cap aerials replacing long wires. At lower frequencies, these aerials have low radiation resistances and high reactances as seen from their input terminals. At medium and high frequencies in the HF band, from say 10 to 30 Mc/s, the radiation resistance of these aerials is comparable to 50 ohms, and the reactance is usually not very great. However, from 4 to 10 Mc/s the reactance is quite large and high voltage is developed at the base of a short aerial.

POWER AMPLIFIER

It was determined that an increase in power to the 1 KW level would be useful in the medium and high frequency ranges and as better antennas are developed more of the available 1 KW can be used on the lower frequency ranges.

A miniature power amplifier, covering from 4 to 30 Mc/s, has been developed, employing self rectification and silicone oil immersion cooling to achieve a volume of but 1/3 cubic foot. Total heat dissipation is 1,275 watts while delivering nearly 1 KW of useful power.

Using the approximation that the power amplifier will have an overall efficiency of 50 per cent, roughly 1 KW of heat will be dissipated in the power amplifier enclosure.

The cooling problem is made more difficult by the fact that the temperature of the entering cooling air may be no less than 250 degrees F.

If air cooling is used, a serious arc-over problem will occur because of the combination of high voltages (several thousand volts) and the low pressure air encountered in high-altitude operation.

Certain silicone fluids exhibit excellent voltage insulation, dielectric constants and relatively low loss along with extremely low vapour pressures.

FLUID IMMERSION

These physical and electrical properties made it possible to design the power amplifier completely immersed in silicone fluid. This fluid immersion provides the voltage insulation and high heat conduction from the heat dissipating elements to the walls of the enclosure and also provides altitude pressurisation.

The disadvantages of this fluid immersion operation are an increase in stray capacitances of the order of 2½ times that in air, change in dielectric constant with temperature, accessibility and servicing difficulties, expansion of fluid with rising temperature and necessity for complete immersion of heat dissipating elements even when the unit is in an inverted position.

The six 4 x 150 power valves are grouped in a sub-assembly installed on its side in the lower left hand corner of the power amplifier enclosure so that the grid lead from the RF input receptacle may be as short as possible. A pump forces the silicone fluid through ducting to the valve assembly.

The amplifier is housed in an aluminium box, with removable side, end and top cover plates. The sides are made of extruded aluminium, incorporating fins to increase the heat dissipating area.

Since the silicone fluid expands nearly 25 per cent over the operating temperature range, an expansion space had to be provided. The expansion chamber is the top portion of the box and is connected by a small tubing between the top of the box and the bottom centre of the chamber.

When first operated, the amplifier had serious parasitic high frequency oscillations in the 160 to 250 Mc/s region. Parasitic suppressors were added in the grid and plate circuits. Due to the amplifier being immersed in silicone fluid and assembled inside a box, circuit modifications were time consuming but not difficult because the valves, variable inductor, transformer and other sub-assemblies are removable and are interconnected entirely by plugs and receptacles.

The silicone immersion increased stray capacitance considerably and necessitated a rework of the pi output matching network to match the power tubes to the load over the entire frequency range.

NEW LEAD IN VITAMIN RESEARCH

ACETONE and acetylene—two cheap and simple organic chemicals derived directly from coal, lime, and water—have been used by a group of American scientists to achieve a "true total synthesis" of vitamin A.

The novelty of this method lies in the fact that it eliminates the need for lemon grass oil. This oil yields pseudoionone, one of the starting materials in today's most widely used commercial processes for the manufacture of vitamins A, E, and K, and of beta-carotene from which the body can build up vitamin A.

Apart from their obvious importance for the life and growth of human beings and animals, vitamins are proving to be valuable factors in the treatment of certain diseases: for example, striking results are reported to have been obtained by their use to increase the life span and delay some aging processes in man; other tests have revealed a marked improvement in the condition of mental patients following the addition of large doses of vitamin to their diet.

Because the production of these essential agents was dependent on an imported raw material (lemon grass grows in parts of Africa, Asia and Central America), the research chemists started to look for a way of making pseudoionone and eventually succeeded in preparing the compound from acetone and acetylene.

In disclosing this at a recent meeting, a member of the team predicted that, in addition to its application in the drug industry, the new method will also provide raw materials valuable to perfume manufacturers for the development of new fragrances, as well as companies engaged in the production of flavours and toilet goods. A multi-million dollar plant for the exploitation of the process is now nearing completion.

CRYSTAL ACCURACY—150 Kc/s to 220 Mc/s!

WITH THE COMBINATION OF

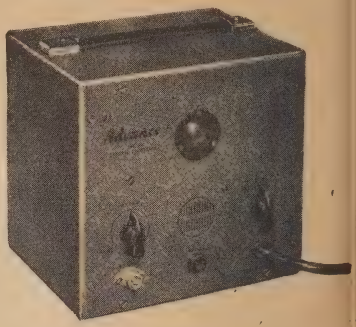
WIDE BAND SIGNAL GENERATOR
MODEL 62

PRICE: £54 (plus tax)

BY

"ADVANCE"

CRYSTAL CALIBRATOR
MODEL 74



PRICE: £48/15/0 (plus tax)

THIS COMBINATION WILL GIVE A SIGNAL OF ANY STRENGTH BETWEEN 1 MICROVOLT AND 100 MILLIVOLTS AT ANY DESIRED FREQUENCY WITHIN THE RANGE OF 150 Kc/s TO 220 Mc/s. AN ADJUSTABLE CURSOR INCREASES THE ACCURACY UP TO .01% IN CONJUNCTION WITH THE CRYSTAL CALIBRATOR.

SPECIFICATIONS

MODEL 62

FREQUENCY RANGE: 150 Kc/s to 220 Mc/s in six ranges.
ACCURACY: +— 1%.
OUTPUT VOLTAGE: 1 microvolt to 100 millivolts.
OUTPUT IMPEDANCE: 75 ohms.
MODULATION: 30% at 400 c/s.
A.F. OUTPUT: 18 volts.
POWER CONSUMPTION: 20 watts.
DIMENSIOSS: 12" x 9" x 6".
WEIGHT: 10lbs.

MODEL 74

FREQUENCY RANGE: 1-250 Mc/s and higher at reduced sensitivity.
CALIBRATION FREQUENCIES: 5 Mc/s and multiples, 1 Mc/s and multiples.
ACCURACY: Better than +— 2 parts in 10,000.
SENSITIVITY: 10 millivolts or less.
POWER CONSUMPTION: 20 watts.
INDICATION: Both visual and aural fro built in speaker.
DIMENSIONS: 7½" x 7⅝" x 7".
WEIGHT: 9lbs.

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NEWS AND VIEWS OF THE MONTH

Next stop Mars

EXPERTS are now planning space ships which can make the round-trip to Mars in a few weeks.

Scientists visualise a stream of electrified vapour thrusting from the rear of the space ships like a violent electric wind.

They claim that ships up to 600 tons could be propelled through space once they are clear of earth's atmosphere.

British, U.S. and Russian scientists are working on the "electric" space ships.

The new method of driving space ships is described as "fantastic."

Called the Ionic Drive, the new method amounts to the thrust of a huge machine through space by a beam of electrified particles instead of a jet of flame.

This was revealed at the international meeting of 300 space-flight experts in Barcelona last month.

"Feasibility studies" on the Ionic Drive are being made at the Royal Aircraft Establishment at Farnborough, Hampshire.

Sir William Penney's atomic scientists at Aldermaston Park and others at Hartwell are involved.

A row developed at the conference over a project to use the moon as a testing ground for H-bombs.

America's Professor Singer led a group which argued that using the moon would prevent further fallout of radio-active dust over the earth.

A much larger group was opposed to any contamination of the moon's surface before it had been thoroughly explored by space travellers.

Animals aloft

REPORTS from Moscow Radio say that scientists are sending animals more than 125 miles into space to study the effects of cosmic radiation on living organisms.

This was disclosed at a conference on inter-space travel in Moscow.

The broadcast quoted a scientist who spoke on research in the higher layers of the atmosphere.

In 1951 animals were taken up to a height of more than 60 miles, he said.

The experiments were successful, and now the heights had been increased.

Many uses for TV

TELEVISION now can do anything from baby-sitting to supervising a roulette wheel.

Reporting a boom in closed-circuit TV, it can also be used to:

- Curb shoplifting in department stores;
- Observe prisoners in cells and work shops;
- Monitor atomic energy processes;
- Conduct underwater fisheries research;
- Watch for "poachers" on parking lots.
- Teach big classes in many centres at the same time.

Closed circuit TV is being used in several private maternity hospitals to keep a central watch over babies in different wards.

In Nevada, gambling tables are scanned through sets embedded in the ceilings of casinos.

Teaching by TV

EXPERIMENTS in use of television to give formal education have proved successful according to officials of San Francisco Government College.

Their claim is based on examination results of several hundred students, who last year took part in a television teaching program.

Four courses were offered in the experiment—psychology, economics, first year English, and appreciation of art, music and drama.

One group of particular interest to the educators was composed of 25 convicts in San Quentin Prison.

"As far as we know," said Dr. Willard Leeds, project administrator, "this was the first time educational television entered a prison."

Examination papers submitted by the convicts produced results comparable to those of the other students.

R.N. order by radio

THE Royal Navy has solved the problem of passing orders on the noisy flight decks of aircraft-carriers.

Flight-deck crews are being issued with hearing-aid-sized radio receivers.

Small amplifiers plug into the ears and can be worn under noiseproof helmets.

The strength of transmissions do not radiate beyond the flight deck.

This new communications system is now in use in the carriers Ark Royal and Bulwark, which are currently taking part in the big NATO naval exercises.

POPULAR SCIENCE QUIZ

Q. What is an atomic clock?

A.: Just as a pendulum in an ordinary clock has a natural period of vibration, so do the atoms of which all matter in the world is composed. An atomic clock makes use of these vibrations to measure time with great accuracy

Q. What is the natural frequency of vibration of atoms?

A.: It depends on the substance. Many of the motions generated in the atomic world are too rapid to be counted by present day techniques and only a few with relatively low natural frequencies can be put to practical use.

Ammonia, for example, has a natural frequency of 23,870 million cycles per second, while cesium has a natural frequency of 9,192 million c/s, placing it in the 3 cm band used for radar. This is an advantage since equipment for handling the waves is readily available.

Q: How accurate are atomic clocks?

A.: Accurate enough to detect variations in the rotational speed of the earth. An ammonia clock at the National Bureau of Standards in the United States is stable within one part in 100 million, while ammonia clocks, one in Switzerland and one in Japan, are regarded as being stable within about two parts in a billion

Recently an atomic clock with considerably greater precision, has been made with cesium, a silvery metal which is liquid at room temperatures. It was made by the same Bureau of Standards scientists who made the first ammonia clock.

Error with the cesium clock is believed to be less than one part in 10-billion. This would correspond to an error in timekeeping of one second in 300 years! At the same time there are prospects with a new technique of improving the accuracy to one part in 1,000 billion or better.

Q: What is the use of such an accurate clock?

A.: The establishment of a really accurate terrestrial time scale will permit more precise measurements of the earth's rotation, which in turn will help geophysicists to chart motions of the earth's molten interior, believed to be responsible for some of the irregularities in rotation. Atomic clocks will play a major part in basic atomic research, making possible easier and more accurate measurement of the vibrations and rotations of molecules, atoms and nuclei.

Another imminent application is to aircraft navigation. Some of the present radio navigation instruments could give accurate position fixes over at least 3,000 miles if the frequency of the radio signals could be held stable to one part in a billion. Only 30 stations would be required to cover the entire globe.

There is a possibility that atomic clocks could furnish a test of Albert Einstein's general theory of relativity. The theory predicts that a light (or radio) wave travelling away from the earth should be slowed, or reduced in frequency, because of the work it does against gravity. A pair of atomic clocks, one at the bottom and the other at the top of a mountain should be able to settle the point. The experiment would be of enormous interest, because there are few ways to check relativity theory.

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Satellites report weather

SCIENTISTS predict that future earth satellites will be able to give warnings on tornadoes and hurricanes before they begin.

They also say the satellites may be able to settle the question of whether any of the other planets could support life of any kind—plant or animal.

The predictions were made by Messrs. W. G. Stroud, R. Hanel, W. Nordberg and R. Stampfl, of the Army Signal Engineering Laboratories at Fort Monmouth, New Jersey.

They envisaged satellites circling the earth at 2,000 miles, high above the ocean of air that prevents man from obtaining a clear picture of his atmosphere and what lies beyond it.

The scientists presented their predictions at a 13-nation conference on rocket and satellite programs of the International Geophysical Year.

"The generation, growth, and course of hurricanes and typhoons will undoubtedly be observable," the army scientists said, as would conditions causing thunderstorms and tornadoes.

Long-distance TV

RESEARCH into communications may soon make intercontinental television practicable.

The Overseas Telecommunications Commission revealed this in its annual report to Parliament.

The report said that at present the main bar to long-distance television transmission was that television transmission took up large blocks of channel space.

But scientists were now working on a method to expand greatly the capacity of both cable and radio communications systems.

This method was known as bandwidth compression.

If they were successful the carrying capacity of intercontinental radio and cable systems could be expanded to make intercontinental television practicable.

The report said bandwidth compression meant that the frequency or wavelength required to transmit a given type and quality of service was reduced.

"When a solution is reached the carrying capacity of such radio and cable systems as would warrant the added cost and complication of bandwidth compression could be increased perhaps as much as tenfold.

Heart and humans

A HUMAN being could stand a temperature of 900 degrees Fahrenheit for a brief period before collapsing, a University of Washington scientist reports.

The temperature of boiling water is 212 degrees.

The scientist, Mr. Konrad Buettner, reported on the effect of high temperatures on human performance in a paper delivered in San Francisco to the American Society of Mechanical Engineers.

Mr. Buettner's figures indicated that under some conditions, a man "covered with one centimeter of clothing might remain as long as a minute and a half in air at 900 degrees Fahrenheit without collapse."

"Without protective clothing, he might survive a 300-degree temperature for th same period," Mr. Buettner said.

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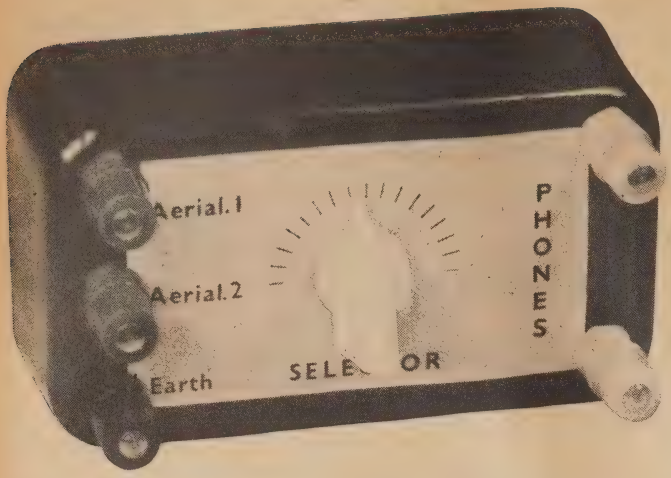


Here is a view of the latest in crystal sets. It is housed in an attractive plastic cabinet with a lettered label and will most likely be available in kit form.

Simple Crystal Sets For Beginners

"Surely, dad, you can build me a crystal set?." This question may have been directed at you on more than one occasion or perhaps "junior" wishes to tackle the construction himself. Whichever the case may be, here are two sets which we suggest that you can build up. Attach an earth and an aerial and you can have your radio programmes for virtually nothing.

by Wes Yashin

NOTWITHSTANDING the number of crystal sets we have described in the past, the popularity of these simplest of radio receivers has not waned. A never-ending demand for circuit reprints, stocks of which are continuously being exhausted, prompted us to build and describe the sets featured in the following paragraphs.

Unlike other receivers, crystal sets require no power for their operation and use only a handful of components that should last indefinitely. Children may use them without danger of shock and without interfering with the listening habits of their elders.

ESSENTIALLY SIMPLE

Crystal sets are essentially simple devices to build. All that is required is the ability to follow a simple circuit or wiring diagram. Whether Dad or Junior tackles the project, a couple of hours of instructive entertainment may be spent in the construction and adjustment of such a set.

Admittedly, the crystal set can only be relied upon to give worthwhile results in strong signal areas and in conjunction with a good aerial and earth. However, lots of people live in such areas.

A good aerial is a worthwhile installation anyway, while a good earth is readily available at the nearest waterpipe.

Most of the sets we have described to date have been simple affairs using a single tuned circuit consisting of a capacitor and a coil. The sets we are about to describe are no exception and the same simple circuit is used. The tuned circuit consists of a coil, provided with a number of tappings, and a variable capacitor having a maximum capacitance of just over 400 pf.

The tappings on the coil are for the aerial and detector circuits and are very important, since they provide the basis for individual adjustment after the set has been completed.

Signals reaching the set via the aerial are fed to a tapping on the coil. The coil is tuned by a capacitor and is made resonant or receptive to only one frequency within the broadcast band at the one time.

Stations on other frequencies are rejected, while the wanted signal builds up maximum voltage and current in the tuned circuit. The wanted signal, which is as large in magnitude as is possible without resorting to amplification, is then fed to the detector via a further tapping on the coils.

CORRECT TAP POINTS

It is essential to choose the correct tapping points for the aerial and the detector circuits. Tapping the aerial across a large proportion of the coil will give the loudest signals but the selectivity will become poor. In other words the stations will tend to overlap.

Bringing the tapping point closer to the earthy end, on the other hand, will improve the selectivity at the expense of signal strength. The tapping should be used which gives the best balance between selectivity and signal strength.

The results just discussed will vary with the length of aerial. Generally speaking a long aerial will have to connect to tappings close to the earthed end, while a short aerial will connect further up. Location also will, to some extent, influence the final result.

Connecting the diode across the major portion of the coil is rather like placing a resistor across the coil, loading it and spoiling the selectivity. Here again we must compromise between maximum signal with reduced selectivity and maximum selectivity with reduced signal.

The signal picked up from the tapping is passed on to the diode for detection or demodulation — the process of separating audible signals from the radio frequency carrier. The demodulated signal is then used to activate the diaphragm in the headphones to produce sound.

CONSTRUCTIONAL

The foregoing should give the prospective builder some idea of the manner in which the set functions. Now for some constructional details.

We suggest here two ways in which a crystal set may be built. The first using "breadboard" construction and large components, including a rather bulky handwound coil. The second uses miniature components and a commercially made pi-wound coil, the whole contained in an attractive plastic cabinet.

There are obvious advantages in each method of construction, although the

arger version will be slightly more effi-
cient on account of the higher "Q" of
he handwound coil. The larger version
an also use bits and pieces that may
e on hand in the junk box.

On the other hand, the smaller version
as much to commend it, in its neatness
nd compactness. It uses standard com-
onents and it is very likely that it will
e released as a complete kit of parts.

For the breadboard version a base-
oard and a panel will be required. Size
ill depend on the exact components
vailable but, in our case, the baseboard
easured 6½ inches wide by 4 inches
eep. The panel is 7½ inches wide by
inches deep. Scraps of plywood held
ogether by glue, panel pins and brack-
ts should be quite suitable.

Anyone handy with woodworking tools
hould be able to knock up a box to
ouse the completed set.

We finished the panel and baseboard
n a grey enamel but this may obviously
e varied to suit the taste of individual
onstructors.

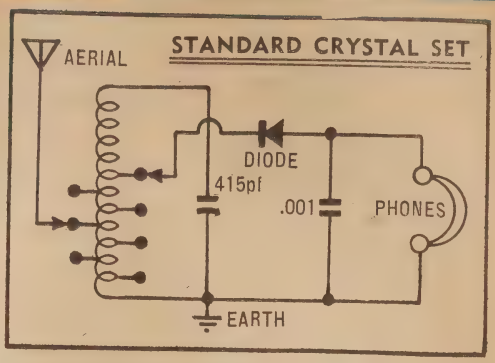
UNING CAPACITOR

Coming to the construction of the set
self, the variable capacitor should be
ounted so that portion of the spindle
rotrudes through the front panel. Bal-
nce is essential for a neat appearance
nd the spindle should be so positioned
ong the vertical line as to balance with
e terminals.

A knob with a hole to suit the spindle
ill be required but, as an alternative,
e capacitor may be placed further
ack and a 3/8 to ¼ inch extension
aft fitted to the spindle, so that a stand-
d ¼-inch knob may be used.

Short woodscrews were used to se-
re the capacitor to the baseboard but
ountersunk bolts and nuts may be used
stead. The dial shown in the photo-
aph is drawn on white card and after
justment and calibration the call signs
e inked in and the whole covered
th clear celluloid and pinned to the
nel.

Coil winding will be the most tedious
b in building the set but no special
ill is called for. 22 B & S wire
suggested because it will ensure the



The circuit as used for both units. There is nothing new about it, but it has proved to be one of the best and simplest. Popular demand has caused us to reprint.

largest and most efficient coil on the available former.

We suggest that you use the same gauge of wire although thinner wire may be used with reduced efficiency, while thicker wire will need a longer former.

Using 22 gauge wire, drill two small holes close together and 3/8in in from each end of the former.

Have a match ready with the head trimmed off, for you will need it to support the tapping points.

Loop one end of the wire a couple of times through one set of the holes and wind on five turns, keeping the wire taut and the turns placed accurately side by side.

Slip the end of the match under the fifth turn and then pass the sixth and succeeding turns under the match again. When the tenth turn is reached, push the match along and run the tenth over it, the eleventh and succeeding turns going underneath again.

Continue in this manner until 35 turns have been wound giving seven taps at every fifth turn. After the 35th turn, wind on the rest to make 80 turns, the final turn being looped a coupled of times through the holes in the end of the former.

A hole at each end of the former will allow brackets to be attached for mounting to the baseboard.

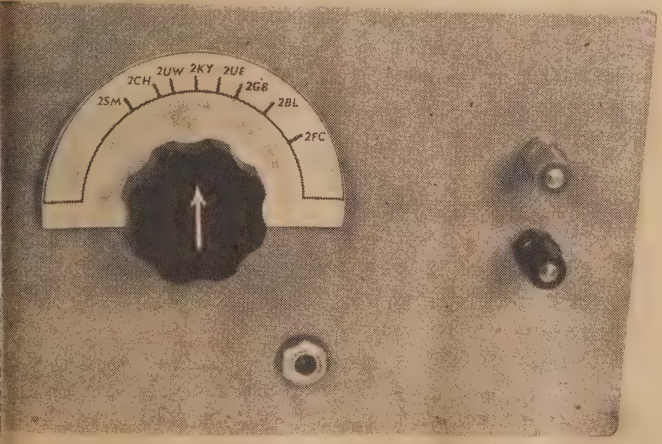
PARTS LIST

FOR BREADBOARD VERSION

- 1 Baseboard and panel (size to suit components used).
- 1 Variable capacitor 400 to 500 pf.
- 1 3-inch length of 2-inch dia. coil former.
- 1 Length of 22 B & S wire (approx. 50 feet)).
- 1 Knob to suit capacitor spindle.
- 1 2-lug strip.
- 1 Germanium diode.
- 1 Pair of headphones, preferably high impedance.
- 1 Phone jack and plug.
- 2 Terminals (red and black).
- 1 .001 capacitor.
- 1 Length of hookup or tinned copper wire, solder, nuts and bolts or wood screws.

FOR KIT VERSION

- 1 Plastic cabinet.
- 1 Miniature variable capacitor (Roblan).
- 1 Crystal set coil.
- 1 Pointer knob.
- 1 Germanium diode.
- 5 Terminals (multicoloured).
- 1 Pair headphones, preferably high impedance.
- 1 .001 capacitor.
- Short length of hookup or tinned copper wire, solder, solder lugs and two 3/8 x ¼ counter-sunk screws.



The front view of the breadboard version stresses the simplicity.

TERMINAL MOUNTING

Before mounting the coil, mount the terminals and the jack on the front panel. Since the panel will most likely be of wood or bakelite, insulation problems do not arise and insulating washers will not be required.

Mount a two-lug terminal strip midway between the coil and the variable capacitor and you can then proceed with the wiring.

Almost any type of wire may be used for the wiring and the placement of leads is not critical. The diode is mounted between the lugs of the two-lug strip while the .001 mfd capacitor is suspended between one lug and an earth point. Make sure that the wiring does not foul the moving plates of the capacitor.

Almost any of the available german-

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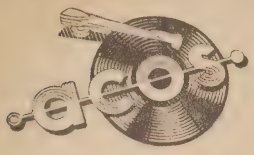

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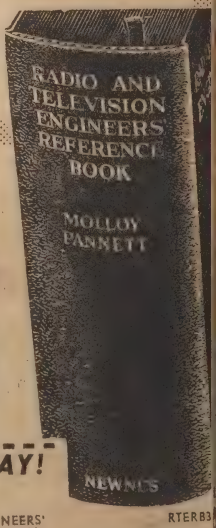

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ium diodes will be satisfactory and their polarity in the circuit is not significant. They will work either way round.

Care must be taken however, not to apply excessive heat from the soldering iron, as it may possibly damage the diode. The suggested idea is to hold the pigtail close to the diode with a pair of long-nose pliers till the joint has cooled.

When the wiring is complete, the set is ready for adjustment and calibration. Connect the aerial and earth to the appropriate terminals and a lead from the aerial terminal to the first tapping from the earthy end of the coil. The diode may be connected to the second or the third tap.

Plug in the headphones and rotate the variable capacitor in search of a station. Try the effect of various tappings on the coil, since results will vary according to the length of aerial and location.

Moving to tappings further removed from the earthy end produces what is known as "tight" coupling and results in poor selectivity but higher signal level. There is room for quite a lot of experiment.

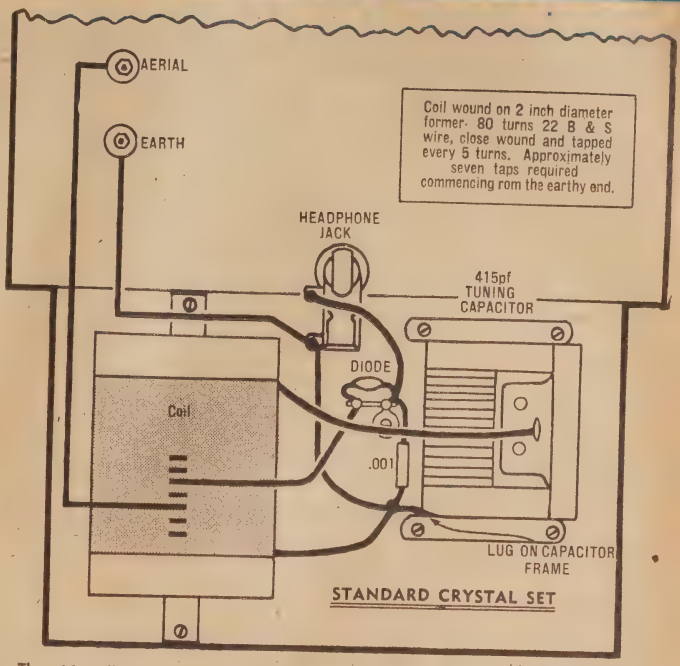
COMMERCIAL COIL

A commercially made pi-wound coil was substituted in place of the hand-wound unit and gave adequate coverage with reasonably good selectivity. Use one, by all means, if you don't feel like tackling the hand-wound coil.

Now a word about the smaller version, photographs of which are reproduced. By the time this issue is on sale, a complete kit of parts might be available. The plastic box will come with all holes drilled in the correct place and the only tools required to put a set together will be a screwdriver and a soldering iron. This may be a decided advantage to some of the junior constructors.

Both versions use an identical circuit and only one has been published. The component layout is clearly visible from the photograph and a separate wiring diagram has not been prepared. However, the following descriptions should leave no room for doubt.

WIRING DIAGRAM OF CRYSTAL SET


AERIAL
EARTH
Coil wound on 2 inch diameter former. 80 turns 22 B & S wire, close wound and tapped every 5 turns. Approximately seven taps required commencing rom the earthy end.
HEADPHONE JACK
415pf TUNING CAPACITOR
DIODE
Coil
.001
LUG ON CAPACITOR FRAME
STANDARD CRYSTAL SET

The wiring diagram of the breadboard version. The wiring is particularly simple for the reason that there is very little of it.

The coil is mounted directly between three terminals which are on the left hand side of the box. Four colour-coded lugs act as terminals for the windings and taps. Black denotes the end of the winding and the lug connects to the fixed plates of the capacitor.

Looking down at the lugs on the coil, green is the next lug adjoining the black on the left hand side. This green lug is a tap and goes to the topmost aerial terminal on the box. The diode is anchored between this aerial terminal and the topmost headphone terminal.

The remarks made in an earlier paragraph regarding the soldering of diode leads apply equally as well.

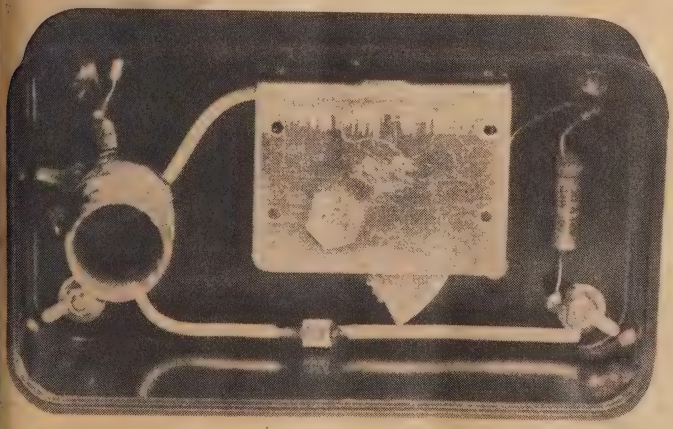
The next in line is the red terminal which again is one of the taps and goes to the second aerial terminal which is mounted between the topmost aerial terminal and the earth terminal. This red lug connection gives better selectivity than the green position but at reduced volume.

The final lug is coded yellow and is the earthy end of the winding. This lug goes to the lowest of the three terminals and a lead within the box connects it to the lowest of the headphone terminals. To this earth point also bring the frame of the variable capacitor, thus earthing the moving plates.

A .001mfd capacitor, anchored between the headphone terminals, will complete the wiring.

A discussion on aerial taps and connections in an earlier paragraph applies as well in this instance although the choice is somewhat restricted, since only two taps are available.

If possible, use high impedance headphones, 2000 ohms to 4000 ohms being quite suitable. Low impedance headphones will work but may be less sensitive than good high impedance types.



A rear view of the kit version showing the neatness and simplicity of layout. All components are suspended between terminals and a minimum of effort is necessary in assembly.

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What is a good aerial for a crystal set? We have frequently written upon this point, but we mustn't forget there are always newcomers to radio to whom these things are still news.

With a crystal set, as already hinted in the article, a certain amount of compromise is necessary.

Those things which are desirable for strong signals are, in the main, opposite to those required for good station separation.

If you are in the suburbs, and within easy range of local stations, you will not need as much aerial as if you are further away.

But in most cases, a length of wire strung outdoors will be required for good signal strength.

In the suburbs, about 30 or 40 feet of wire should be effective, and you should try to hang the wire as high as possible

INSULATION

Fortunately insulation isn't a great problem in these days when there is no trouble to obtain plastic insulated hook-up wire which can be tied to objects, even if they are metal without much effect on efficiency.

The days when you needed to string a length of bare copper wire between two poles and provide a string of insulators at each end are largely gone. Stations are now much stronger, and the plastic covering is just as good as the porcelain insulators for our purpose.

If you have the set in your bedroom, for instance, you could run a length of wire out through the window — it doesn't matter if the window closes upon it as long as it doesn't tear the insulation in so doing — and up to a chimney.

There it can be fastened with a loop of light rope, and taken away to some point as high as you can find.

A hook screwed into a board near an outhouse roof, for instance, would do for an end support.

If you have any doubts about a tie-point cutting through the plastic wire covering, you can buy quite small plastic insulators and use one of these to make sure.

If you are lucky enough to have a high tree handy, you can attach the end of the aerial to it, although take care to see that the branch to which it is tied doesn't sway about too much in the wind and break the wire.

HEIGHT IMPORTANT

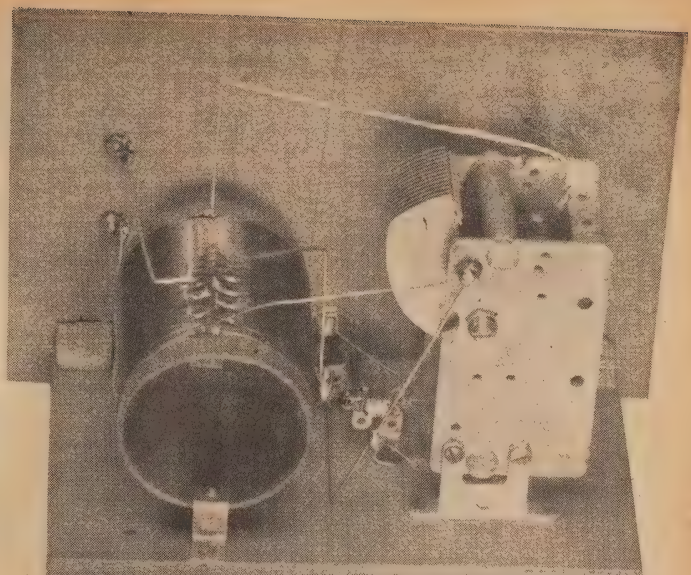
Height is more important than length and the aerial should not run between high buildings, or too close to iron roofs which would shield it from the best signal pick-up.

If you are some distance from the radio stations, you will probably have to use a longer aerial, and a higher one, but readers have reported reception of strong stations in the country over very great distances.

The earth wire is nearly as important as the aerial with a crystal set. With an AC receiver there is generally an earth connection through the mains circuit, but the crystal set is on its own.

The best and simplest earth is a length of water pipe, long enough to drive about three feet into the ground, preferably in a dampish spot. It is an advantage to keep the earth lead as short as you can, and it may be of the same wire as you used for the aerial.

It must make good contact with the pipe, and a solid clamp is the best way to ensure this.



A rear view of the breadboard set showing the layout of components. Major variations in layout are possible to accommodate components.

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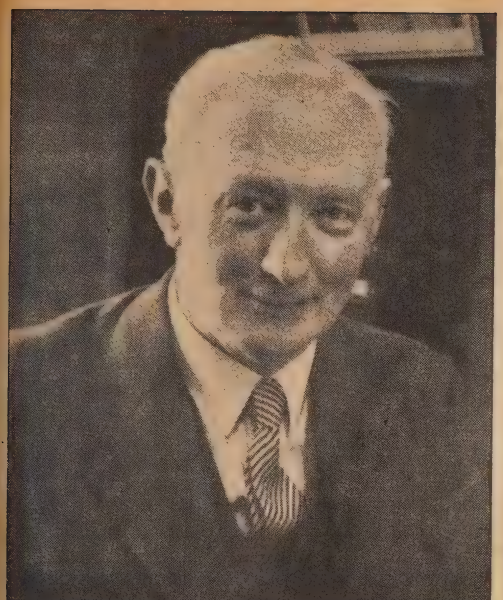

MR. GILBERT A. BRIGGS

All About Audio And Hi-Fi

This is the first in a series of articles about high quality audio reproduction written by a man whose views are the outcome of many years experience and experiment. Not everybody agrees with some of his ideas, but all value them for their sincerity, open mindedness, and clear statement. This article deals with the nature of listening as related to the characteristics of the human ear.

By G. A. BRIGGS

By special arrangement with the Author and Radio and Television News, U.S.A.

I WAS very pleased to receive from the editor of this magazine an invitation to contribute a series of articles on audio topics, now generally designated as hi-fi. Because I am constantly making tests and experiments, it is very useful to have an incentive to place the results on record whilst they are fresh in the mind. In these experiments I have the valuable co-operation of our technical director, Mr. R. E. Cooke, B.Sc. (Eng.), who joined my firm some two years ago after spending a few years in the Designs Department of the B.B.C. where he was engaged on problems connected with sound recording and reproduction.

INTERCHANGE OF IDEAS

Another reason for satisfaction is that I believe that any interchange of experience and opinion is a good thing in the present state of the world, apart from the obvious fact that we can learn a lot from each other.

To conclude this preamble, I would like to stress the point that music and its reproduction are intended for man's delight, and my main reason for writing on the subject is that I enjoy doing so. Let us therefore approach all problems in a gay rather than a sombre mood.

The title, "All About Audio and Hi-Fi," may be rather ambiguous. It does not mean that I am going to tell you all there is to know about it. (I do not know it all, nor do I think I know!) It simply means that I have a roving commission to deal with all or any aspects of the subject.

I sometimes think that the term "high fidelity" has just about reached the limit set by the large notice which appears on the front door of a dance hall on Broadway, which reads: "Most Exclusive Place in Town — Everybody Welcome." It is now quite usual to see portable radio sets and record players advertised in England as "hi-fi"; but despite this the term means something when properly applied, and it is very difficult to replace by a better one.

PART 1 — THE LISTENING EAR

When listening to loudspeakers in unusual rooms, allowance must be made for differences compared with furnished rooms in which domestic speakers are normally used.

For instance, our laboratory has a longer reverberation time and sounds much brighter than an ordinary room. Some beneficial acoustic treatment has been applied; perforated Celotex tiles absorb excessive high frequencies over part of the walls, and half a dozen acoustic absorbers, designed by R. E. Cooke, each 5ft x 2ft operate in the range 100 to 8,000 cps. These units combine the functions of a Helmholtz resonator, stagger-tuned over the frequency range 700-1,300 cps, and a membrane absorber. Nevertheless, I still prefer to make a final loudspeaker test at home, when domestic types are involved.

ROOM EFFECTS

Room effects obviously play havoc with any loudspeaker response although they do not invalidate the merits of level response as a starting point.

In view of the importance of listening tests, we cannot do better than devote the remainder of this article to an elementary study of the function of the human ear as related to the problems of sound reproduction.

Its main qualities could, I think, be classified very simply as follows: (1) Sensitivity, or general acuity of hearing; (2) Response or variation of acuity with frequency; (3) Tonal discrimination and power to assess volume levels accurately; (4) Sense of pitch; (5) Musical reaction and talent; and (6) Uniformity of qualities 1 and 2 between left and right ear.

For our purpose, the most important is No. 3, tonal discrimination, but we will deal with the others first.

JUDGES OF QUALITY

Qualities 4 and 5: It is obvious that any of the six qualities could be possessed to an exceptional degree by one person, with only fair or even poor ability in the others, although it is reasonable to assume that Nos. 4 and 5 usually go together. (It is difficult to imagine that even an ultra-modern composer cannot hit the right note—or at least the one he wants.)

But experience shows that professional musicians are often poor judges of quality No. 3, and may be defective in qualities 1 and 2. (Beethoven was deaf for many years.) The reason for No. 3 failure is that the musician usually spends so much time near to the source of sound.

I remember at rehearsals in the Royal Festival Hall, the organist Ralph Downes always maintained that we were reproducing the organ too loudly when he came into the body of the hall to listen.

Similarly, a member of an orchestra hears something quite different from the conglomeration of direct and reflected sound heard by members of the audience.

Volume level has a lot to do with it; I always maintain that the art of attaining realistic reproduction starts with set-

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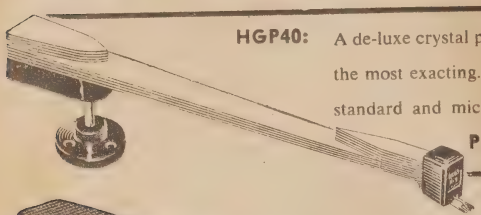

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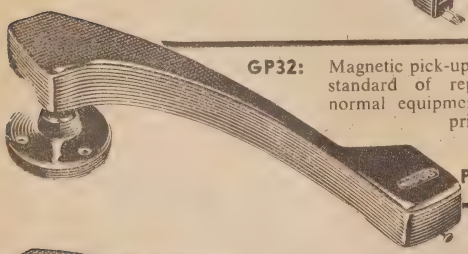
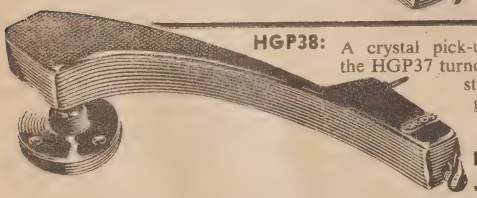


GP32: Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage, ½ volt at 1,000 c.p.s. **PRICE, £2/12/6**



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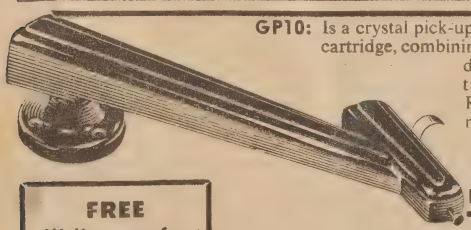

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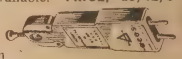

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ting the volume control correctly. The slightest touch up or down can make all the difference.

The organist, when playing on a console placed near the pipes, hears less than his audience, but a member of an orchestra hears more, so the training for No. 3 is poor in both cases.

It is also difficult for very musical people to ignore the music and performance, and concentrate on quality of reproduction. Many hi-fi fans err in the opposite direction!

Qualities 1 and 2: At the outset, we must be careful not to attach too much importance to acuity of hearing. We have already agreed that it has little to do with musical ability, and it is fairly easy to prove that sensitive ears are not necessarily discriminating ears, any more than a man with good eyesight is ipso facto an artist or a good judge of line and colour.

RANGE OF HEARING

But a reasonably good range of hearing is obviously required before any reliable assessment of tonal quality can be made. This was brought home to me recently during a rehearsal for a record concert, the items for which had been chosen by a talented musician and composer who was apparently stone deaf above 5,000 cycles and remained quite oblivious to surface hiss, plops, and screaming highs which came from some records.

It is well known that hearing at high frequencies falls off with advancing years, but constant use of the ears in listening tests delays the decay.

The September, 1956 issue of "Wireless World" contained an interesting article on age, hearing, and hi-fi entitled "Too Old at—?" by M. G. Scroggie, who said that those of us who are not so young as we were may be wondering why we should spend a lot of money on equipment for reproducing frequencies we cannot hear. Some measurements made on a few individuals by Mr. Scroggie are reproduced in Fig. 3, the numbers against the curves indicating the ages of the people tested. Frequencies below 1,000 cps are omitted because no significant differences occur.

After studying these curves we decided to make a few tests ourselves on members of our staff but whereas Mr. Scroggie used moving-coil headphones, we used moving-coil speakers, and this may account for the fact that our results showed much better standards of hearing at the high frequencies than did those of Mr. Scroggie and previous investigators. (After all, it is more natural to listen with two ears open to the air than with clamped-on headphones.)

SOUND GENERATOR

A 3-inch unit with aluminium voice coil and light bakelised cone was used as the sound generator. Although not quite the response goes up to 20,000 cps (see Fig. 4) and the unit should be at least as good as a headphone. I was astonished that all those tested—ages between 20 and 46—could actually hear 16,000 cycles (usually with a boost of 50 db or more) as I am stone deaf in that region.

Now there are three people whose hearing and tonal judgment I have also rated very highly when assessing speaker performance. They are (1) my daughter, age 22; (2) our works manager, Mr. E. R. Broadley, age 46; and

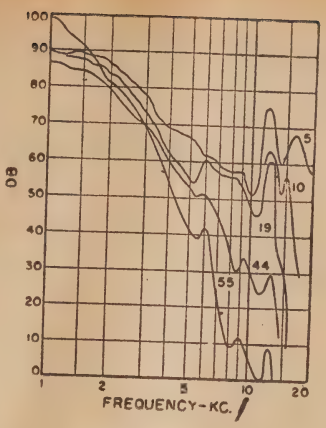

Fig. 3. Results of hearing tests made by M. G. Scroggie on persons of normal hearing between the ages of 5 and 55. Curves have been compensated for Fletcher-Munson threshold levels. (Curves redrawn from "Wireless World.")

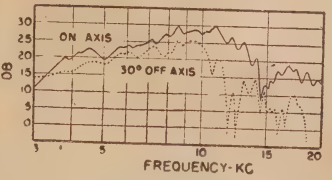

Fig. 4. Response curves of the 3-inch speaker used in the listening tests.

(3) myself. Please do not take the inclusion of myself as a sign of arrogance or conceit. We all think that what we hear is right because we never hear anything else.

As a matter of interest, response curves of these three subjects, prepared by Mr. Cooke, are shown in Fig. 5.

As already mentioned, Mr. Scroggie used moving-coil headphones, no doubt in a very quiet room, and in such circumstances the threshold-level Fletcher-Munson curve gives appropriate compensation.

Our experiments were made without headphones in a laboratory where slight background noise may be expected to produce some degree of masking at low intensities. The results have therefore been compensated by the Jensen threshold curve for a critical listener in low noise level.

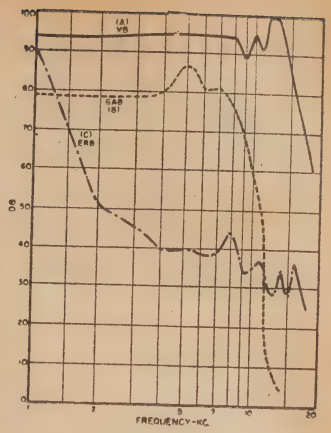

Fig. 5. Hearing curves taken with speaker held a few inches away from the right ear. Curves are corrected for loudness contour and are smoothed below 3000 cycles. Curve (A) is for G. A. Briggs, age 66; and curve (C) Miss Briggs, age 22; curve (B) is for E. R. Broadly, age 46. See text.

These tests show that it is possible for a young person of 22 to hear perfectly up to 14,000 cycles and quite well up to 18,000 cycles. Our sales director, Mr. Escott, age 31, and Mr. Cooke, age 32, kept within 15 db of this standard up to 18,000 cycles limit imposed.

Although I can actually hear 14,000 cycles, I was shocked to learn that I am some 90 db down at this frequency. The most interesting ears belong to Mr. Broadley, whose acuity is below mine up to 10,000 cycles, but then remains very even up to 18,000 cycles, in spite of his 46 years. He has been making and testing loudspeakers along with me some 25 years, and I rate his judgment of performance very highly.

LOSS WITH AGE

The general conclusion, as a result of these tests, is that loss of hearing with advancing years is frequently not as bad as has so often been assumed, and the faculty of hearing — in common with many other human accomplishments — is preserved by regular exercise or practice (like playing the piano or knitting).

It is a pity that deficiencies in hearing cannot be adjusted by "spectacles" which are so easy to prescribe for the eyes. Deaf aids are little better than resorting to any port in a storm.

Quality No. 6: Few people hear equally with both ears, but I believe the

(Continued on Page 105)

Mr. G. A. BRIGGS, managing director of the Wharfedale Wireless Works in England, is known on both sides of the Atlantic for his lecture-demonstrations of high quality sound, and as a writer of practical books on Loudspeakers, Sound Reproduction, Pianos and High Fidelity. His books have been best sellers in their field, and his lectures in both England and America have attracted thousands at a time. Originally from the Bradford woollen trade, he commenced experimenting with reproducers as early as 1930, and soon afterwards began making high grade loudspeakers in his modest factory at Ilde, near Bradford. His intensely practical approach and wide experience, coupled with an easy and often extremely witty style, have made his literary efforts universally popular, and we are very happy to publish this series of articles written by him.

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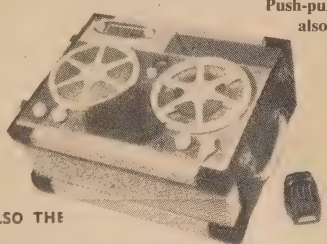

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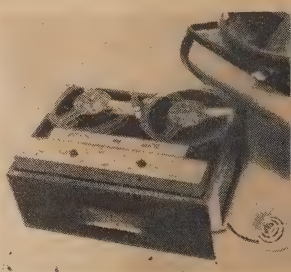

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Here's your answer, Tom!

A major problem that has Tom worried relates to the behaviour of alternating current in the mains and power supply circuits. This and several evergreen queries on circuits and component markings, together with a reprint of a query from last month make up this month's feature.

BEFORE we go any further, Tom, we must apologise for having omitted the circuit diagram of the noise limiter discussed in last month's Answer Tom. So that you may follow the action more easily here again is the text, together with the circuit.

Some time ago you discussed a muting circuit on these pages. Is a noise limiter a similar type of circuit?

Nothing could be further from the truth, Tom, for while the muting circuit is used to silence the receiver except when turned to an incoming signal, the noise limiter is used to attenuate bursts of noise without interfering any more than necessary with the signal.

A circuit we have often used in the past is reproduced and, referring to this the action is as follows: One half of the 6H6 is used for detection in the normal manner, the diode load being made up of two .25 meg resistors in series, the audio being taken from their junction.

The second half of the diode is connected in opposition to the first with regard to polarity. On switching this second half into circuit, the signal reaches the audio stages through its electron stream.

SECOND DIODE

When thus connected the second diode will only pass signals as long as its cathode is maintained at a potential more negative than its plate. Assuming the full voltage that is developed across the diode load to be 20 volts, then the DC voltage from the split load will be 10 and the standing bias applied to the diode cathode will be 10.

The purpose of the two 1 meg resistors and the .01 capacitor is merely to act as an audio filter to ensure that no signals reach the limiter cathode while allowing the DC to be used as required.

From the foregoing, it is obvious that any signal or noise peaks in excess of 10 volts will not pass through the limiter diode. Since noise peaks may quite easily reach values in excess of this, they are not passed on to the audio system.

Modulation of approximately 100 per cent may be handled and slight distortion of modulation peaks may be experienced, but not sufficient to spoil intelligibility.

The obvious advantage of the system is that since the limiter standing bias is obtained from the detector diode load, limiting action will be approximately the same irrespective of the signal strength.

The usual narration describing the transformer/rectifier network of a radio receiver usually contains similar words to: when the current reverses on the second half cycle, etc.: I have not been able to work out exactly how the current reverses in the ordinary domestic power point whose business wires are an active and a neutral which never interchange as far as I can work out. The power point is actually one branch of a three phase star connected system in which the current pulses along each phase wire in turn and returns along the neutral to the sub-station.

What you say, Tom, is only partly true. The basic flaw is your implication that the current flows in pulses in a specific direction through the power wiring and "returns along the neutral to the sub-station."

Let us forget the multiple phase system and analyse the action in the simple single phase supply to which your receiver is normally connected.

When the circuit terminating at the power point is closed by an appliance such as the primary of a power transformer, a current flow will take place. Since this is alternating current its direction of flow will change 50 times a second, in the case of a 50 cycle supply.

As far as the power transformer is concerned current will flow through its primary first in one direction and then in the opposite direction.

The fact that one side of the line happens to be at earth potential will have no effect on the direction of current flow, nor will it modify the performance of the power transformer.

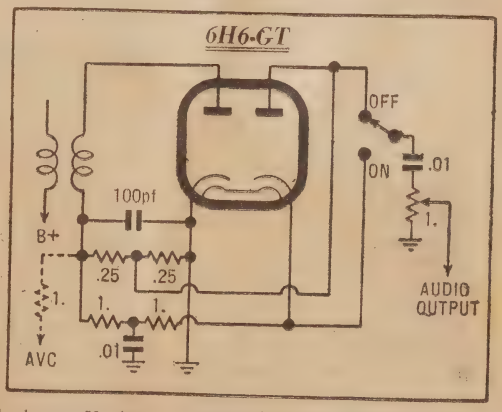
As the current flow through the primary reverses its direction, it causes the magnetic lines of force in the core to build up, collapse, build up in the reverse direction, collapse again, and so on, in periodic fashion.

This movement of the magnetic field induces current and voltage in the various secondary windings. Some are designed to give AC output to supply the heaters of the various valves. The high tension secondary winding, on the other hand, has to deliver a high voltage AC output, which is subsequently rectified and filtered to become pure DC for the plate supply.

The high tension secondary winding is usually centre-tapped, the centre-tap being connected to chassis. It follows that, in the presence of an alternating magnetic field, current will flow in the secondary, first in one direction, then in the other.

At one instant, one end of the winding will be positive in respect to earth and the other end negative. During the next half-cycle, the position will reverse.

Since the two ends are connected to the respective plates of a rectifier valve, it follows that first one section of the rectifier will conduct, then the other.



The circuit of a noise limiter discussed here. A twin diode valve is used, the respective halves being connected in opposition with regard to polarity. A switch is provided to bring one half of the valve into circuit at will. This valve will only conduct as long as its cathode is maintained at a potential more negative than its plate.

From this point onwards, you apparently understand things well enough, Tom.

I have a pair of IF transformers marked IF 1 and 2, that have been stripped out of an old set. The leads have been cut short and I have no idea as to which lugs to use since there are no colours or other markings to guide me. Is it possible to determine, from the internal wiring, the significance of the various lugs?

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In the average IF transformer it should not matter a great deal if the primary and secondary windings are interchanged. However, for your guidance, we have observed that frequently the grid winding occupies the top section of the former while the plate winding is wound on the lower section nearest the base.

It is also customary to connect the respective ends of the windings to pins diagonally opposite one another. Observe the performance using one set of connections and then reverse the two sets of leads interchanging plate with B-plus and grid with AVC. Should there be an improvement in the performance, then that may be taken as indication of the correct connections.

The reason for there being a difference in the order of connection of the windings is due to the coupling between them. This coupling is mainly magnetic but there is also a capacitive component which may either add to or detract from the magnetic coupling result in instability, then the reversed connections are called for.

Will any set of IF transformers or coils suit any valve types or is it necessary to buy these to match?

With the exception of the oscillator coil, standard IF transformers and coils may be used freely with different valve types, without affecting performance too much.

Because of their inherently lower gain, battery type valves generally work better with higher gain transformers, although more standard types are quite usable.

The transformers you have to be careful of are deliberately low gain types intended for use in receivers having two IF stages. A pair of low-gain transformers used in a single-stage circuit would give disappointing results. Conversely, three high-gain transformers built into a two-stage IF channel would probably give hopeless instability.

These are exceptional cases, however, and we feel that you could fairly safely use any pair of IFs you may have on hand or are likely to salvage from older sets.

In the circuit of a Colpitts oscillator, it appears to me that the two variable capacitors are in series. I would therefore assume that their total capacitance range is halved, yet the circuit is still capable of tuning in the full band. Where is the catch?

There is no "catch," Tom, only an explanation.

The thing which governs tuning range is not just the maximum capacitance but the ratio of maximum capacitance to minimum capacitance.

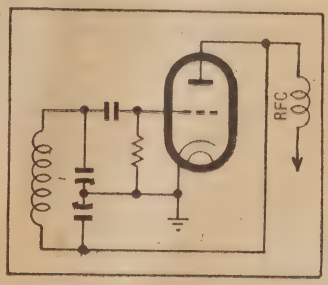
With a typical single gang, this ratio is 415 to 10pF. or just over 40:1. Since the tuning ratio is the square root of the capacitance ratio, a figure of about 6.4:1 is indicated.

Now with two gang sections connected in series, both the maximum and the minimum values are halved, leaving the ratios exactly the same.

That's not the end of the story, however, because in a practical circuit, a certain amount of stray capacitance is inevitably present in parallel with the tuning capacitor. Since it may double or treble the minimum capacitance without much affecting the maximum, it always reduces the capacitance ratio and tuning ratio by a quite significant amount.

The effect of parallel stray capacitance is likely to be greater where the gang sections are in series, as in the Colpitts oscillator. However, there is the compensating factor that many of the capacitances in a Colpitts circuit are only across one half of the tuning coil and gang—between grid or plate and earth.

Because a proportion of the stray capacitances in a Colpitts oscillator are



The basic circuit of Colpitts oscillator discussed here.

effectively in series, they affect the tuning range rather less than one might expect. As a result, the tuning range of a Colpitts circuit is only slightly less than one using a single section capacitor in a conventional circuit.

The Colpitts circuits needs more inductance in the coil, of course, to tune over the same frequency band.

Can two or more valves be used to amplify a crystal set?

They most certainly can. With care it should be possible to design a suitable audio amplifier, free from microphony and instability. As an alternative the output from a crystal set may be fed into an existing high gain amplifier.

However, were you to go to the trouble of designing a suitable amplifier and of providing so many valves and parts, it would be scarcely worthwhile to keep the crystal detector.

Far better overall performance may be had if the first stage were made a regenerative detector. Greater selectivity and gain may be obtained with less valves using this system and we suggest that you invest a couple of "bob" in a circuit through our query service.

Which is the correct way of showing earth returns in a circuit? I have noticed that some come to a central point while others drop anywhere.

Your confusion seems to have arisen from the methods which individual designers and draftsmen have adopted to show earth returns. Some feel that it is less confusing to plant earth symbols wherever they occur in a diagram, grouping none at all unless they are so close together that it is the obvious thing to do.

Others group all the earths together with individual stages. Still others bring their earths to a common line which is shown heavier than any other and is connected to earth.

They all mean the same however, for it can be assumed that no matter how long an earth return is shown in the circuit, it will be connected to the nearest convenient point on the chassis.

(Continued on Page 105)

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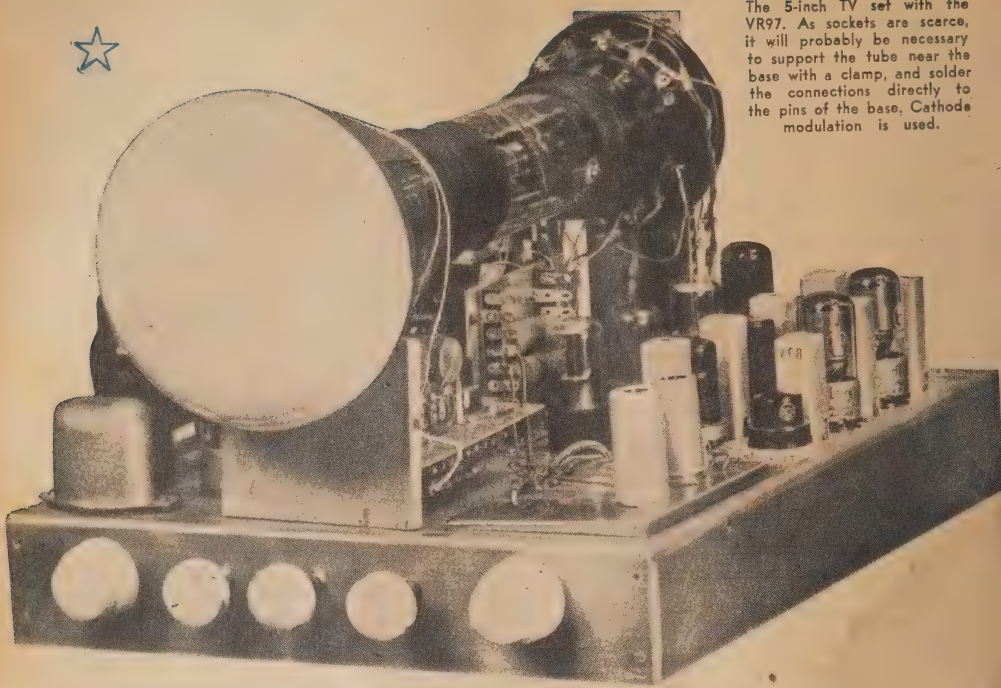


The 5-inch TV set with the VR97. As sockets are scarce, it will probably be necessary to support the tube near the base with a clamp, and solder the connections directly to the pins of the base. Cathode modulation is used.

Valve Types For 5-inch TV Set

Almost any of the cathode ray tubes normally used in test instruments can be used for TV receivers, although screens of less than 5 inches diameter are not popular because of the tiny picture. In this article we give some details of experiments with several tubes still available on the disposals market. Of these, the VR97 holds the most promise.

by John Moyle

IN originally laying out the design of the set, we had in mind the many people who already have 5BP1 cathode ray tubes bought in the days when these tubes were sold very cheaply, and stowed away against the day when they might be useful.

It is quite obvious that large numbers have used these tubes for their experiments, as well as much other disposals material, for the sale of 6AC7's in particular seems to have taken a sharp rise in the last month or two although fewer kits of parts have been sold.

SUPPLY OF CRT's

It is fairly certain that most of these valves have gone into TV sets, for it would be too much of a coincidence to believe otherwise.

The source of 5BP1s seems now to have dried up, and only an odd one or two are likely to be available. This fact has focused attention on other cathode ray tubes, several types of which are still appearing in the advertisements of disposals firms.

Chief of these is the VCR97 which seems to be in fairly good supply. During the last month we took the opportunity of trying out some of these tubes with a view to assessing their value in the receiver.

The VCR97 is a larger tube than the 5BP1. It screen is a nominal 6in in diameter, and it is a little longer from screen to base.

The base itself is rather a massive affair in moulded bakelite and with side connectors, so that a special socket necessary.

There are very few of these socke about, but the side contacts are larg and it is quite practicable to solder lea directly to them, a practice which w actually allow shorter leads than using a socket.

ROUNDER FACE

The face of the tube is not as flat that of the 5BP1, so that the pictu isn't quite as much larger as would first imagined. However, when deali with a picture of this size, even a sm amount extra is worth while.

It is very difficult to obtain reliab information about tubes of this type. they were intended for Service use a their full specifications were not gen ally published.

However, it does appear that t VCR97 is a close equivalent to a curre type known as the ECR60, and althou we have not undertaken a close analy

of operating characteristics, this would appear to be correct.

It is a 4 volt filament tube with a current of 1 amp. A convenient way of obtaining this voltage is to wire a fixed resistor of 2.3 ohms in series with one filament lead, and operate the filament circuit from the normal 6.3 volt winding of the power transformer.

The simplest way of obtaining such a resistor is to cut a small piece from a radiator or jug element, adjusting its length until the filament voltage at the tube is 4 volts.

We were fortunate enough to obtain a socket for the tube, and there is a vacant pin position alongside one of the filament connections. We simply soldered our manufactured dropping resistor between these two points and used the erstwhile vacant connection as the wiring terminal for the 6.3 volt lead.

NORMAL EHT

If you haven't a socket, you can simply include the length of resistance wire as part of the filament lead. Best leave it coiled up so that the wire occupies the least space.

The normal E.H.T. for this tube is 2,000 volts, so that it fits in quite well with the voltage provided by our E.H.T. power supply. The A2 voltage, used for focusing, is given as 250-450 volts, which again works in quite well with the general scheme. As mentioned later, however, we suggest some amendments to the total resistance in the E.H.T. bleed supply.

Unfortunately there are some limitations to certain versions, which was one reason we did not say much about it in our earlier articles.

We found with quite a number of the tubes that it was not possible to deflect fully in one or both directions, so that the image will not reach the edge of the screen.

Before it does so, the electron beam will strike the deflecting plate concerned, and its shadow will appear on the face of the tube not as a sharp line but as a diffused area from light to dark.

Up to this point the picture on the tube will otherwise be normal, but the size will be restricted, and in a bad case could be smaller than that available from a 5BP1.

TEST ADVISABLE

It will be wise, therefore, when obtaining one of these tubes, to make sure it has been tested beforehand to see that the restricted deflection will be absent or at least only slight.

Judging from visual inspection of the electron gun there were about three different versions of this tube, but although they are reputed to vary in suitability, we did not find, after testing about a dozen, that there was much difference between them.

It could even be possible that, in a set in which obviously has little to spare in the way of deflection angle, more or less rough handling has been responsible for small misalignment of the deflecting plates, but there does seem to be more room for it than that.

Very few tubes will be completely free from this characteristic, which would appear to have been a defect in the original regular use, where full deflection to the edges of the screen in both horizontal and vertical directions was not required.

Maybe its designers did not foresee that we would want to use it for TV receivers!

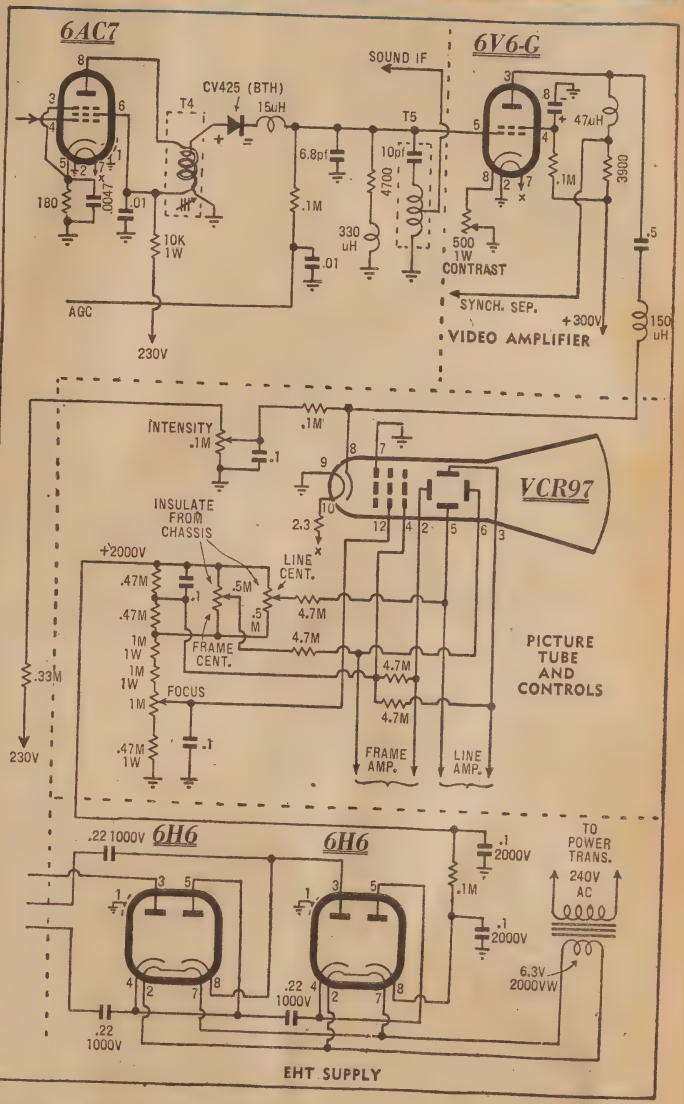
When used in our set, we found that there was enough brilliance to take care of any tubes which could be considered as being within limits, and mostly excess brilliance with a green tube is not conducive to the best quality picture.

When viewed in a subdued light, free from any direct rays to the face of the tube, moderate brilliance will generally be found to give the best modulated and sharpest pictures. After you have operated the set for a time, you will learn to adjust brilliance, focus and contrast for the best quality picture, and not merely for the brightest one.

Under these conditions the picture is extremely good, and quite equal to a good 5BP1 equivalent, so that the net result is, on the whole, to be preferred to that from the smaller tube.

The socket connections are not the

CIRCUIT FOR CATHODE MODULATION



This amended portion of the original circuit shows the connection for cathode modulation, connections for the VCR97. Amended values are also given for the EHT voltage divider and for the capacitors in the supply to provide a little more voltage.

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ame as those for the 5BP1, and we how here a diagram of them. The nost important difference, however, is hat the VCR97 has a separate connec- ion for the cathode, and this allows s to make some changes to the circuit hich simplify and improve it.

You will remember that the 5BP1 as the cathode connected to one side f the filament circuit, so that picture odulation had to be applied to the rid for best result, rather than to the athode as is usual with normal TV re- eivers.

It is possible to modulate the cathode, s we shall see later on, but this places e capacitance between the filament condary and primary directly across e video output stage, with a rather vere loss in high frequency response. And if this method is used at all, a parate filament transformer is re- uired, because the filament winding of e set is connected to the chassis.

ATHODE MODULATION

You will remember, too, that in order obtain the correct polarity of AGC ltage from the detector diode, voltage the picture grid, and pulses for the nch separator, two video stages were cessary.

But if we can modulate the cathode, circuit is simpler. The required larity of the picture voltage is now posite in sign, and can be obtained m the plate of a single video ampli- . From this same point we can ob- the synch pulses which, however, considerably higher in amplitude. is allows the synch separator to work re efficiently.

The over-all video amplification is er, but it is still enough for all prac- l purposes. The extra stage originally d had quite a low gain, and was not any means essential for this purpose ne.

n any case, by using a modern video put tube such as the 6CH6, which not particularly expensive, the lost of the stage we have removed can largely made up, as it is considerably ter than that of the 6V6.

ut for ordinary suburban use, we nd that either valve worked well.

nother advantage of cathode modu- on is that we do not require a back resistor in order to obtain a voltage varying the intensity.

ENSITY CONTROL

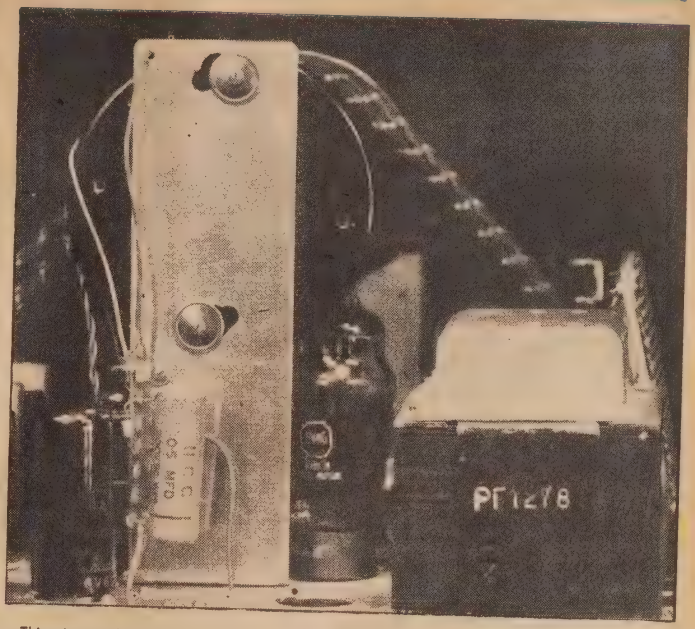
his is done in the original circuit by ing a potentiometer across the back resistor and returning the grid cir- to the moving arm.

ne grid now being earthed, intensity aried by varying a positive voltage the cathode rather than a negative ge on the grid.

the original circuit, the back bias tor accounted for an appreciable ge which was subtracted from the high tension. Without this drop an command about 330 volts instead out 290 or a little more, depending ne exact characteristics of the trans- er you use.

e importance of the extra volts, ever these may be, is that deflection ifiers and synch separator can oper- nore efficiently. The extra voltage t enough to worry any components e high tension circuit, none of which should have a working limit of less than 350 volts.

The change-over is made by wiring the video amplifier, whether a 6V6 or 6CH6, into the socket position originally used for the 6AC7. This allows a short lead to run across to the video detector which is, as before, directly coupled into the diode.

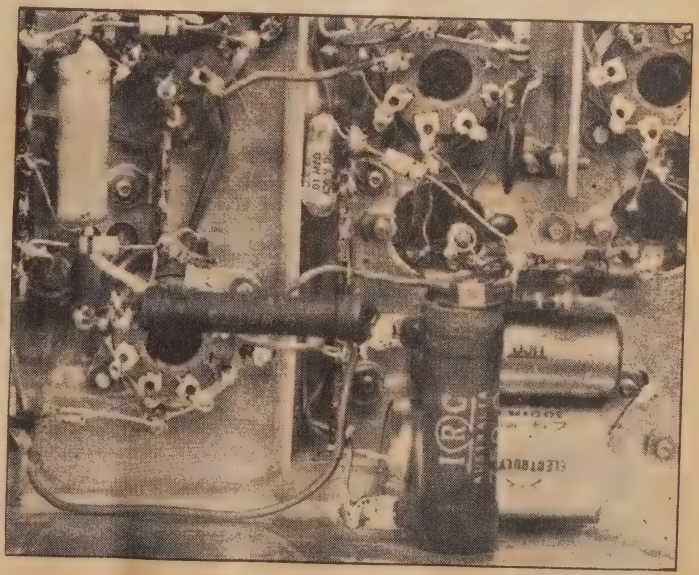


This picture shows the receiver from the rear. The cathode coupling capacitor resistor and peaking choke are mounted on a tag strip on the socket bracket.

The lead to the synch separator is still made to this socket so that the lay- out here remains virtually unchanged.

The contrast control is now wired to the cathode pin of the new video ampli- fier, and its leads are therefore no longer than before.

We save some components, too, as the screen, plate, and decoupling resistors



An under chassis picture of the new connections for the video amplifier.

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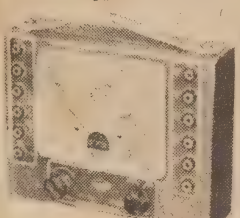

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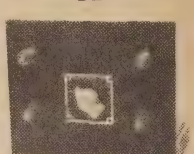

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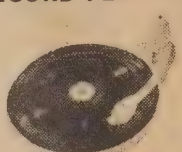

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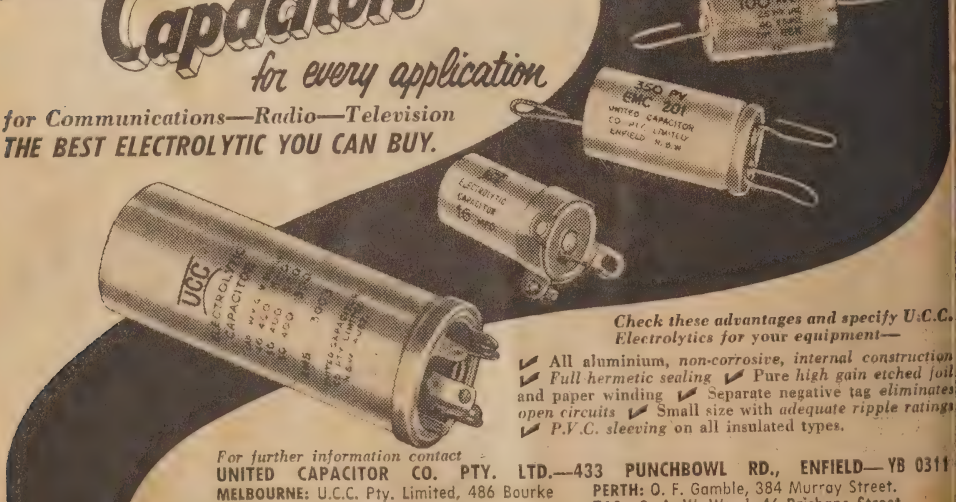

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and capacitors associated with the 6AC7 are removed.

The plate load for the video amplifier remains at 4,000 ohms.

All these connections are shown in the circuit diagram which accompanies this article.

If you should have a socket for the VCR97, you can follow our example and make a metal bracket which bolts to the rear end of the chassis, and fasten the socket to it at the appropriate height. If you have no socket, you can make a clamp to held the tube at the socket end, and bolt it to a lip bend at the top end of the bracket.

A second bracket around the tube near the front end will hold it firmly, and no one should have any difficulty about this.

None of the tubes we have seen have been fitted with shields, and as a matter of fact, we found very little reaction on the picture from the presence of the power transformer, which was of a special TV type.

UBE SHIELD

However, we did make up an effective shield from two pieces of soft iron sheet which a friendly plumber rolled to the right diameter, and which we clamped around the gun section of the tube.

The old trick of using a piece of water pipe would be better still, but its diameter would need to be awkwardly large to clear the diameter of the socket. As the amount of shielding apparently needs to be small, you can experiment with almost any piece of iron sheet.

In the interests of frequency response, it is a good thing to keep the lead to the cathode as short as possible and away from other leads, particularly those carrying deflection voltages.

For this reason, we mounted the coupling condenser and peaking choke on a tag-strip mounted on the back side of the tube-mounting bracket.

The bracket affords some degree of shielding from the rest of the circuit and the lead length and capacitance to ground are reduced to a minimum.

You will notice that the coupling capacitor to the cathode of the tube is .1 mfds. This value is necessary to preserve good low frequency response in conjunction with the .1 meg. cathode biasing resistor. A greater resistor value than this is not advised, as, of course, it carries the cathode current of the tube.

ID CONNECTION

Smaller capacitor values will give appreciably weaker "blacks" in the picture, and less positive synch pulses.

The grid connection of the tube may be earthed to the mounting brackets, as this provides a low resistance path back to the vicinity of the video amplifier.

Incidentally, when wiring the dropping resistor for the filament, see that it is the "hot" lead and not the one connected to the chassis, if your filament unit is earthed at one side. Otherwise the filament of the tube will actually be at ground potential on both sides, and this may not be a good thing.

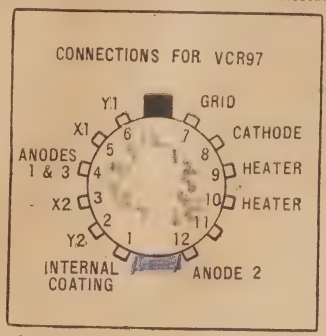
The cathode-to-ground capacitance of the tube is not very high, and although probably does affect the response at the high end, it is not very drastic.

We made a frequency check of the video amplifier, with the input fed to the grid, with the diode circuit connected, and the output voltage read at the cathode of the tube.

Using the constants named, the response was no lower than about 4 db up to 3 Mc. After that point it fell away fairly rapidly, but experiment has shown that no appreciable improvement in definition can be noticed by extending the response beyond this point, and it might be rather difficult to manage.

The response did not show very much change at various positions of the intensity control, and there was no sign of ringing in the video circuit.

The peaking chokes in the detector



Socket connections for the VCR97 Numbers refer to circuit connections. Read from the rear of the tube

circuit are those normally used here, and we simply adopted them from standard circuitry. Their presence, however, does improve picture definition.

The response with either the 6V6 or the 6CH6 did not show very much difference, not enough to justify the newer valve merely on this ground. Its main value, therefore, seems to be in producing more gain which at times could be useful.

The same plate load seems to be about optimum with both valves, and not much improvement, but less gain, seems to follow a reduction to 2,000 ohms.

BETTER LOCKING

The improvement on the frame and line locking with this circuit over the original circuit is noticeable, and a little better than with the revised circuit given in last month's issue.

This is due almost entirely to the higher voltage available for the synch separator and the better clipping action at the first grid.

It makes the removal of video information, particularly from the line circuit, more certain.

It also allows the clipping action to take place right down to the level of the synch pulses, whereas in the earlier circuit there was a greater tendency to synch on the blanking pulses if signals were not strong.

Thus we found less tendency for the picture to give an occasional "roll," and an inspection of the line and frame pulses on the C.R.O. made it quite clear that this was in fact due to better separation of the synch pulses.

In the original circuit, the screen of the 6V6 was bypassed by a .1 mfd capacitor.

But now that we are extracting the synch pulses from the plate of the output valve, it is quite important to extend the response at the low end as far as possible to avoid their mutilation.

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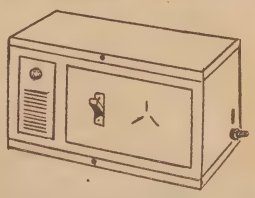

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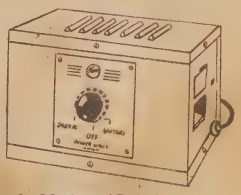

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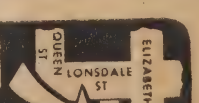

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We have, therefore, increased the value of the screen bypass to 8 mfds, using the capacitor which previously decoupled the plate circuit of the 6AC7 first video amplifier.

Even in the original set, it is a good plan to increase the value of this capacitor, as the blacks will be strengthened by so doing.

As a matter of interest, we tried the effect of a small value bypass capacitor at the cathode of the video amplifier, thus providing some high frequency compensation at the lower level settings of the intensity control. We found this lifted the high end of the curve a little at such levels, but the difference was not great. About 100 pf should be about right if you would like to try it.

GOOD FILTERING

Because the synch pulses are now taken from the plate of the video amplifier, good high tension filtering is more important to reduce the possibility of hum appearing on the picture. An extra capacitor of 60 mfds across the output side of the filter choke improved this point, and we suggest it is now a good thing to use as much capacitance here as you can.

If you can procure a 100 mfd capacitor of suitable rating, so much the better. It would even be practicable to decouple the video plate circuit using a high value capacitor and 1,000 ohms 5-watt resistor, as the slightly lowered voltage will not affect the gain, and full output voltage isn't required of the valve.

Considering now the E.H.T. circuit, the VR97 appears to have rather a heavier cathode current than the 5BP1, and it is possible that the E.H.T. may be somewhat lower using the original constants.

It is a good plan, therefore, to reduce the drain of the voltage divider across it by increasing its total resistance as shown in the circuit.

And to obtain more easily the right focusing voltage, the value of the focusing control may be increased.

At the moment, we are using a value of 1 megohm, which gives a very wide range of controls, although the exact focusing setting is rather sharp.

HIGHER VALUE

You will probably find .5 megohm would be just as useful, but we used the higher value because we were testing a wide variety of tubes and we found their correct focusing voltage requirements were just as wide.

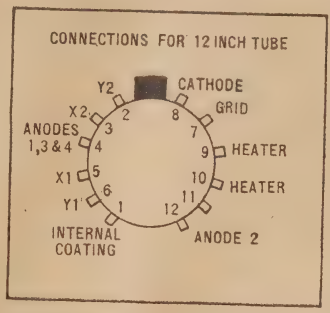
If you have the same experience, varying the value of the resistance at either end of the control should give you the best adjustment. But try to see that the total bleed resistance remains at approximately the same figure.

With higher values all around in the E.H.T. bleed resistance, the voltage developed across the .5 meg. resistors may not be enough to allow the shift voltages to centre the picture. If so, the value of the .5 meg. resistors across the potentiometers might be increased to 1 meg. It should be noted that the position of the picture on the tube will change as the intensity is varied, and any adjustments of the shift voltages should be made at operating intensity.

Note, too, that the focus will need adjustment if the intensity is altered. This is a characteristic found on all electrostatic tubes of this type.

In order to see how the tube behaved with the highest voltage we could command, we increased the value of all the capacitors in the E.H.T. circuit to .22 mfds. One of them already has this value.

As mentioned in the original article, this increased the E.H.T., so that, together with the higher value of bleed, we ended up with just over 2,000 volts as read on an ordinary multi-meter with a 10,000 volt range.



Socket connections for 12-inch tubes such as the VCR131. Numbers show connections to the circuit — they are not pin numbers. Read from the rear of the tube.

This increased the available intensity of the tube quite noticeably, but more important, it also increased the definition.

Thus, while the tube appears to work quite well as low as 16-1,700 volts, it is quite in order to try a higher figure if you wish.

However, with a good tube there is ample brilliance.

SENSITIVITY

The sensitivity of the tube is greater on the whole than the 5BP1 and, despite the larger screen, we did not find it difficult to deflect, particularly with the extra voltage now available for the deflection amplifiers.

One set of plates is about twice as sensitive as the other and we used this set for the horizontal lines.

While there was nothing much to spare in a vertical direction, we were able to fill the screen with the picture.

If you have a tube which has a restricted amount of scan in one direction, it might be profitable to change the connections to the X and Y plates for the restriction may be taking place in one direction only.

However, as a rule, it will be necessary to use the most sensitive set of plates for the horizontal scan, otherwise you may not be able to achieve correct aspect ratio for the picture while preserving maximum size.

The VR97 can be used in the original circuit, using grid modulation, with results which are almost as good. The only change we found desirable was to increase the value of the EHT bleed to increase the available voltage.

But some tubes may need extra back bias to allow a greater control of intensity and, of course, this extra voltage must be subtracted from the main supply.

It is better on all counts, therefore, to use the amended circuit given here, rather than to fit the tube into the original 5BP1 circuit.

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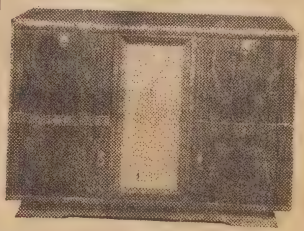

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used the 5BP1 with cathode modulation by connecting the filament to a separate 6.3 volt transformer.

With a standard type transformer, the secondary to primary capacitance was high enough to seriously reduce the video response at the high end, and lower the definition of the picture. It was still quite reasonable, but not up to the best results we have had.

As an experiment, we tried winding our own filament transformer—a 1 to 1 ratio fed from the filament winding of the set.

We used a core stack approximately the same size as that normally used for a filament transformer—actually we wrecked a standard type for the purpose —and used as much spacing as possible between primary and secondary to keep the winding capacitance low.

The results were decidedly better, picture definition being quite good.

TURNS RATIO

Unfortunately, our initial turns ratio was a little too low, and our transformer became rather hot. But if you would like to try out the idea, we suggest you use gauge 20 enamelled wire or a near equivalent, working on 12 turns per volt. Each winding, therefore, would have about 75 turns.

The amount of spacing between windings, which you can make up by binding with insulation tape, should be as much as there is space to accommodate.

If you can manage to space the secondary over only portion of the primary, so much the better. To make up for losses it's a good idea to use about five more turns on the secondary as on the primary.

Because the characteristics of transformer iron, etc. are likely to vary, we cannot give more accurate instructions for the rewind, but you shouldn't go far wrong with the above figures and, in any case, it doesn't take long to make a few experiments.

On the other hand, it may be more convenient, and just as cheap, to keep to the original circuit.

Another type of tube still available is the CV1112, a 5-inch type with a white screen. It has three connections taken through the neck of the tube, one for A3 and two others for a pair of deflection plates.

Perhaps we were unlucky, but we did not have much success with this tube.

WHITE SCREEN

The white screen sounded attractive but in practice we found this of rather coarse grain and not nearly as good in this respect as the green tubes.

We found, too, that most of the tubes were difficult to focus well, although some users have reported that they have been more successful.

Although it has a 3,000 volt rating we found it rather hard to deflect even with 2,000 volts.

It may be significant, but the best of the bunch we tried had a green phosphor screen which appeared to be of good quality and there may be a few of these about.

The tube has an extra anode, the voltage for which will be found marked on the label pasted to the base, but we found best results by connecting it to the focusing anode or to the hot end of the focusing potentiometer.

As we didn't persevere with this type, these remarks can be taken only as a guide.

Sockets for the tubes are not available, but it is quite easy to solder connections directly to the lugs around the base.

One of the most interesting tubes which can be used in our receiver is a 12-inch screen type with a gun very similar to that of the VCR97.

Its type number as printed on the glass bulb is VCR131 and its identification number 10E/156.

There is another 12in tube which looks very like the VCR131 known as the VCR511.

Unfortunately there was so little published about many tube types that it is very difficult to be precise about their characteristics.

However, there may be some doubt as to whether the 511 has the same sensitivity as the 131. We have tried a version of it known as the ACR23, and found that there was not enough deflection sensitivity in the receiver as it now stands to fully deflect the beam. But the picture, although smaller, was quite a good one.

Another type number sometimes found on 12in tubes is the 63DS, but we do not know for certain how it compares with those mentioned.

Because only a few of any type have been available the only sure test is to lay hands on one and try it out.

Its filament is again a 4 volt 1 amp type and the cathode is available for modulation purposes.

VOLTAGE RATING

The normal high tension for this tube is probably about 4,000 volts, but we were able to obtain a very useful picture with about 2,000 as used for the VCR97.

The brilliance of the picture was good enough for a darkened room, or one in which there was very little light, but about 3,000 is really needed to provide a bright picture.

On the lower voltage there was enough deflection voltage to provide a picture about 8 x 6 inches, although, as with the smaller tube, deflection plates limited the picture in a horizontal direction.

From all reports, this is likely to be the only disadvantage of the tube, for, even if the full screen area cannot be used, the extra picture size is most noticeable when compared with the smaller types.

The tube we have has stood in its carton in a corner of the office for about 10 years, but fortunately it has shown no deterioration during that time.

As far as focusing is concerned, it provides a sharper picture than any other we have tried to date.

Although not as large as a regular TV tube, its size makes it a little awkward to handle, and special care will need to be taken with its mounting. And, of course, we should remember that should one be unlucky enough to break such a tube the danger from flying glass would be considerable, although it is quite sturdily made.

The success we have had with this tube would make it first choice judged purely on results, particularly if a higher EHT can be arranged.

The distribution of EHT voltages appears to be the same as for the VCR97 and, except for the order of socket pins, its connections are much the same.

One or two further points are worth mentioning.

EHT CAPACITORS

The capacitors in the EHT supply were not disposals types, although it is possible you will be able to find some which will be suitable. They were supplied to us from Ducon, who assured us they could be supplied from stock as required.

It may be, therefore, that you will need to order them from your radio store.

In the circuit diagram on page 56 of the September issue the capacitor value in the coupling leads to pins 3 and 8 of the 5BP1 from the frame oscillator were shown as .22 mfds.

This was a slip on our part, for this capacitor was composed of two .22 mfds 1,000 volt working types in series. Its value therefore should read .11 mfd.

Although it is preferable to keep this value as high as possible, several readers have used as low as .02 mfd at this point, so that if you have difficulty in making up the full value by all means try a smaller capacitor.

As will be mentioned in the article on the 21-inch receiver, we have found an improvement by increasing the value of the capacitor which couples into grid 1 of the 6SL7 synch separator to .01 mfds.

A discussion of this point will be found in the article referred to.

Apart from these small points there do not appear to be any other changes needed to the circuit as originally drawn.

RESISTANCE WIRE CHARACTERISTICS

The wide variety of resistance wires used in the radio and electrical industries tends to be somewhat confusing and the beginner is often in doubt as to which type should be used for a particular application. In particular, we are often asked whether the resistance wire used for heating elements may be used for winding shunts and similar precision resistors, mainly because such elements form a cheap and easy source of supply in small quantities.

The types usually used for heating elements are Nichrome and Kanthal wire, both having similar characteristics, and which include a relatively poor temperature co-efficient and marked aversion to being soldered, though this latter function can be performed if care is taken. It is obviously useless for precision resistors, though it was used at one time for cheap wire wound resistors. These invariably gave trouble at the soldered joints.

For precision resistors Eureka, Constantan, Advance and Manganin are usually used. The first three are virtually identical, while all four have excellent temparature co-efficients and are easy to solder. Manganin is normally available in both wire and strip form, the latter being used for making heavy duty precision meter shunts.

TRADE REVIEWS AND RELEASES

FERRIS TV RECEIVER OPERATES FROM AC AND BATTERIES

Very good results were obtained on a Ferris Challenger TV receiver which has been sent to us for test. It is unique in that power supplies are available for both AC and battery operation.

EACH power supply is contained in a separate metal box, and it is only necessary to plug the appropriate lead into the rear of the receiver to change from one to the other.

Results are approximately the same with either supply.

This facility makes the set useful for boating enthusiasts, for instance, who would like to take their TV programs with them when tripping in the general vicinity of TV coverage area. To our knowledge it is the only receiver which has this facility.

FIRST METAL CABINET

The Challenger was also the first metal-cabinet model on the market. It is finished in an attractive two-tone colour scheme with gold trimmings, and allows the full surface of the picture tube to be viewed. The tube is a 17in type.

Controls are grouped at the top of the cabinet and can easily be operated in a standing position.

Used in its AC version 16 valves are employed apart from the picture tube.

We took the opportunity to include it among luggage for a weekend trip into the country, so that we could operate it about 200 miles air line from Sydney.

Using a 3-element beam aerial cut for ABN, and about 25ft high in a reasonably elevated site, we were able to receive quite recognisable pictures despite a background of "snow"; good enough to read distinctly four lines of smallish type across the screen.

Naturally much fading was in evidence, and the test was valuable mainly to illustrate the set's performance in poor conditions.

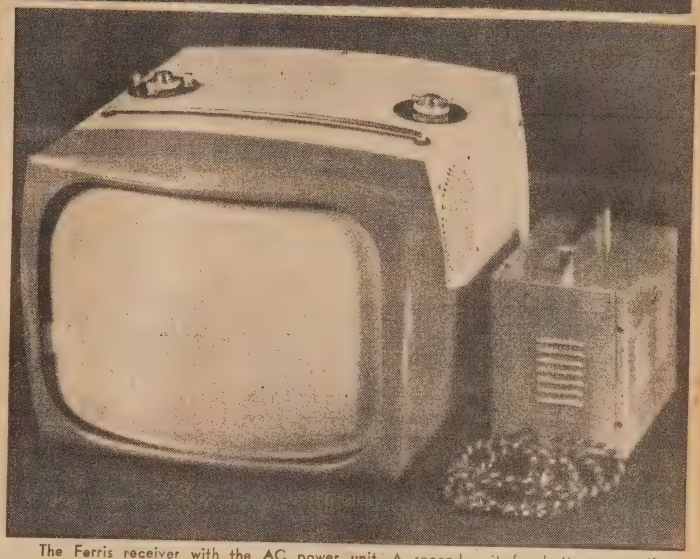
EXCELLENT SYNCH.

More remarkable was the fact that both frame and line circuits locked quite definitely on the synch pulses even before there was any picture visible on the screen.

This easy and positive synchronising is a very valuable asset.

In the city, picture quality was all that could be desired, resolving the best test patterns virtually to the 400 mark.

The sound quality is adequate for general use, although not quite as impressive as one would naturally expect from a more substantial speaker and cabinet.



The Ferris receiver with the AC power unit. A second unit for battery operation is provided. It is known as the Challenger Portable.

TELEQUIPMENT 720 OSCILLOSCOPE

A new oscilliscope, the Model 720 from Telequipment Ltd., London, was recently made available to us for review.

FOR sheer ease of control, the 720 takes a lot of beating.

Principal features are a calibrated vertical amplifier enabling quite accurate measurements, a calibrated time base for measuring rise times, frequencies, etc. and rock-steady synchronising. This makes the instrument particularly valuable for developmental work.

The time base is normally triggered from the vertical amplifier with a choice of positive or negative slopes. The level of the trigger point on the incoming signal can be varied by a panel control, an extremely valuable facility in the case of the complex signals encountered in television, or an automatic trigger position is available in which the time base will follow almost any repetitive signal with a fundamental frequency between about 50 c/s and 2 Mc/s. This feature holds even when the signal has a low amplitude on the screen.

The frequency response of the vertical amplifier is less than 3 db down at 6 Mc/s and the curve slopes off slowly thereafter minimising overshoot. At the low frequency end, response can be judged by the fact that tilt is less than 3 per cent for a 50 c/s square wave.

A 1-volt peak-to-peak signal with an accuracy of plus or minus 2 per cent can be fed into the vertical amplifier via a switch controlled from the panel. Overall accuracy of measurement is of the order of 5 per cent. There is a beam bright-up facility to improve presentation of fast transients. An in-built frequency standard is available at a turn of a panel switch. The time base can be accurately calibrated and can be expanded up to 10 times. A warning light indicates when an uncalibrated degree of expansion is being used.

Overall, the 720 is an excellent instrument and a pleasure to use. At £167 it is excellent value.

The instrument reviewed was supplied by the distributors, Jacoby, Mitchell and Co., P/L, 477 Kent Street, Sydney.

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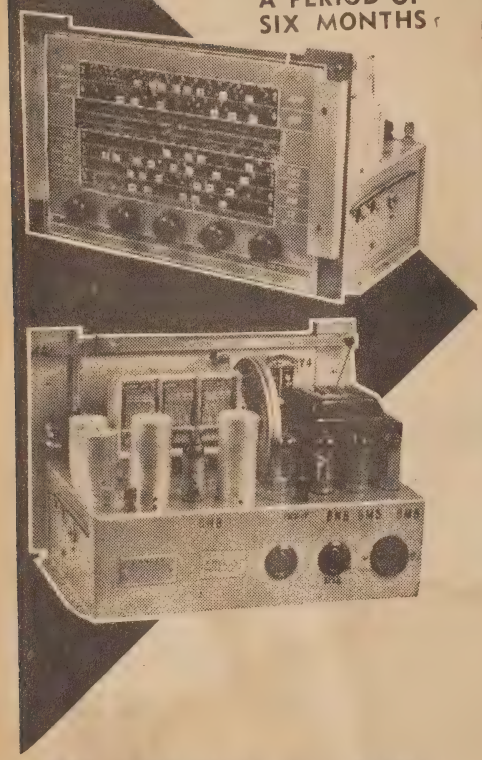

NEW:

Ultra modern circuit using nine high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short wave range of 12,000 miles. All valves used are the new Mullard nine pin innovar series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving + or — 15db., boost or cut at 50 cycles L.F. and 10,000 cycles H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual Speaker combination using a heavy duty woofer (12in M.S.P. Jensen AU54 special) with matching 6in tweeter and cross-over network giving a frequency response of 46 to 13,000 cycles. Speakers are mounted coaxially making only one 11in mounting hole necessary.
If required the new Magnavox high fidelity twin coned speaker can be supplied.

NEW:

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NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.
All chassis are wired for the fitting of an F.M. tuner or tape recorder, spectacle plug being provided on back of chassis, also pick-up terminals and outlet for gramo motor.
Power switch is fitted to volume control, radiogram switch combined with wave change switch. Audio end of set can be used with TV receiver if required.

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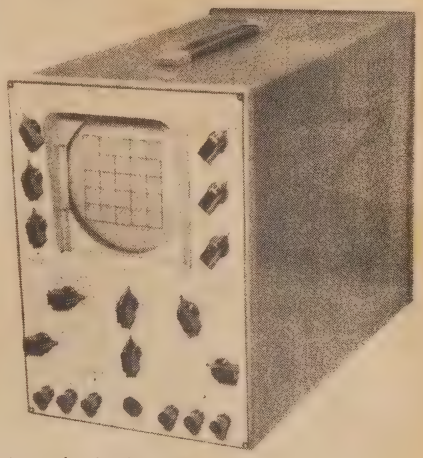

VERTICAL AMP.

Freq. response: 1 cycle to 3.4 mcs. (—3db). Gain control freq: compensated stepped attenuator calibrated in 12 steps from 500mV to 1000V. Voltage measurement accuracy plus-minus 10 per cent.

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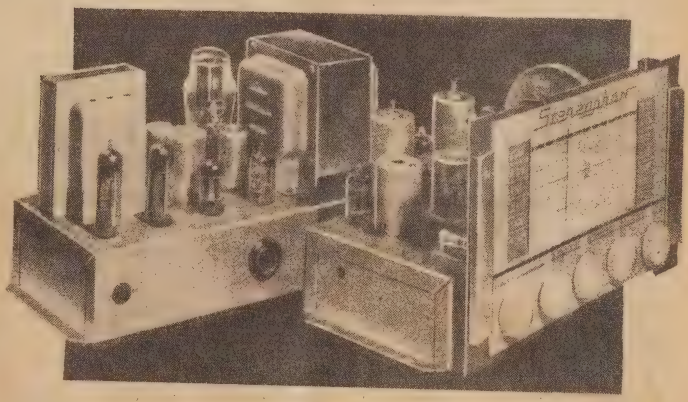

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Pick-up input 1. High sensitivity 5mV
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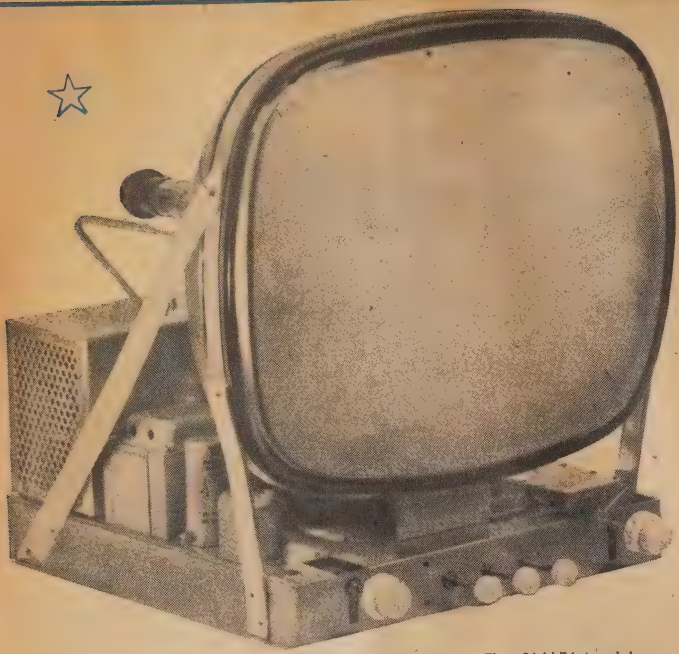


You can build this 21-inch television set in your home. The 21ALP4-A picture tube is mounted on the same chassis as used for the 17-inch receiver, the design being practically the same except for the contents of the EHT cage. Controls are Brightness and Volume on the left, Line Hold, Frame Hold and Contrast in the centre, with Channel and Fine Tune on the right.

Building a 21-inch TV Set

Here's the article which many readers have been waiting for — full constructional details of a homebuilt 21-inch television receiver. Based on our already popular 17-inch design, this new set can be built with only marginal increase in cost and effort. It is our most ambitious project yet — and the most rewarding!

by Neville Williams

WHEN we set out, last May, to describe the 17in version, we led off with a rather lengthy preamble about the story of our own efforts, the parts position, mechanical problems, our reasons for the choice of particular components and circuitry, ideas of who should and should not attempt such a project and so on.

ACCEPTED FACT

Now, seven months later, it is no longer necessary to explain or to speculate about such matters.

Backed up since by our 5in designs, home construction of television sets has taken on in a big way in the areas served by TV. It has become an essential part of our interest and activities and the description of a 21in receiver is a natural step.

We could scarcely tackle it earlier, both by reason of other commitments and the fact that the necessary components and tubes were not available. The position has now improved and readers should have a good chance of getting everything together without too many holdups.

In fact, one of the gratifying aspects has been the willingness of manufacturers and supply houses to help the home constructor, even though sorely pressed by the big-set makers.

What is no less important to us, readers have shown their capacity to build television sets and get them going. In fact, we've been rather staggered by several reports of success from readers who have had no previous experience in set construction at all.

Had they asked our advice beforehand, we'd doubtless have run them off the idea, for obvious reasons.

The construction of elaborate television receivers must be regarded primarily as a hobby and an exercise for those who have already acquired some background in radio work and sufficient resources, if need be, to get out of possible trouble. Most constructors to date have, in fact, been in this category and the project has been of immense practical value, as well as being a medium of entertainment thereafter.

17 OR 21-INCH?

Seeing this present article, many readers will inevitably be faced with the question of which set to build — the 17in described last May, or this new 21in version. Perhaps some who have already built the first will feel tempted to dispose of it and have a go at the new one.

The question of screen size is basically the same as faces the person who wants to buy a commercial set. It involves consideration of the viewing room, the space available, the number of people who want to watch the program, eyesight and personal preference.

If only three or four people are involved and the viewing distance from eye to screen is around 8 or 9 feet, preference might easily be for the smaller screen. Pictures tend to look sharper, close-up, with less obvious line structure, while the smaller cabinet may also be an advantage.

With a bigger room and audience, the larger picture will almost certainly be preferred, simply because it is larger. A 21in screen does not contain or present any more detail than a 17in but it does allow the picture to be viewed in comfort from a greater distance.

In general, people with failing sight will always prefer the larger picture.

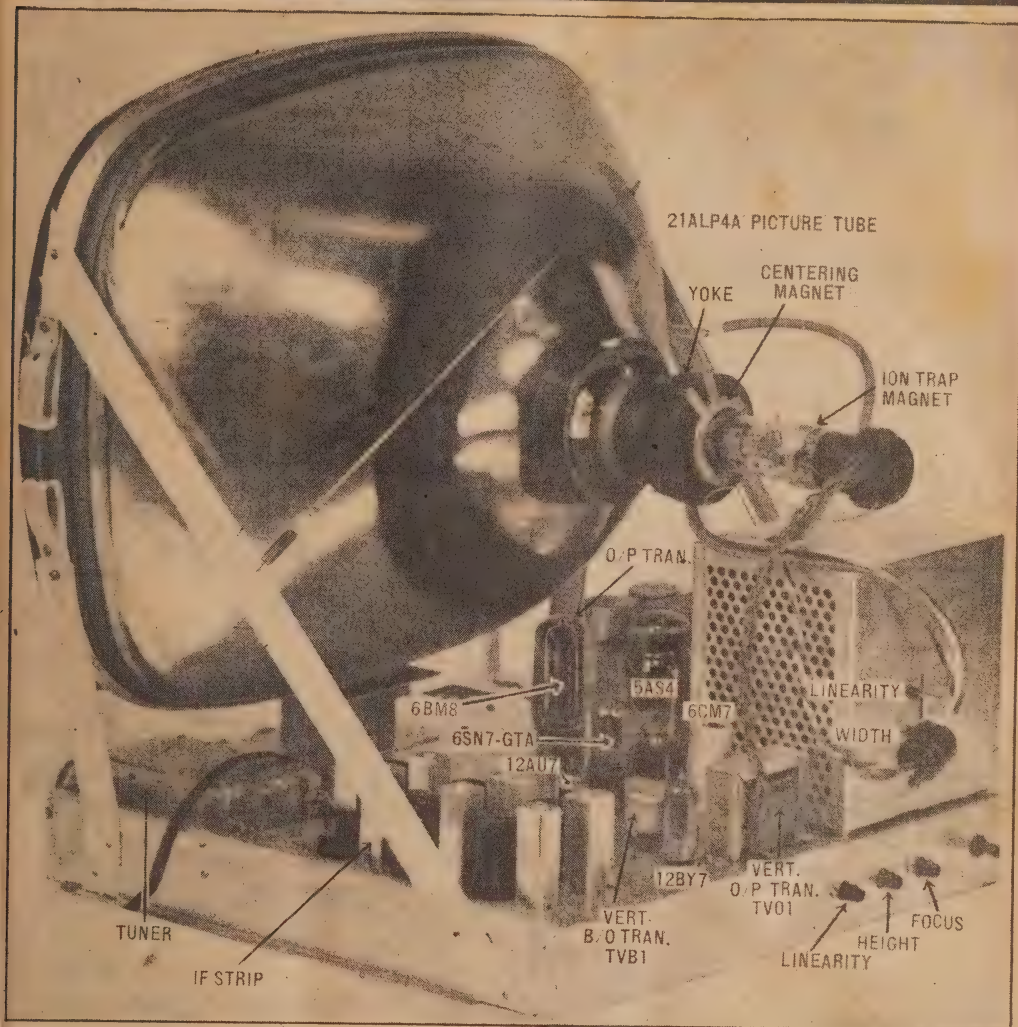
As far as actual construction is concerned, a 21in receiver is rather more costly than a 17in, though the difference is not enormous. The tube itself costs a few pounds more, there are a few extra components and the cabinet work is larger and more expensive.

The extra bulk and weight of the tube calls for more care in mounting and handling but the difference between the two sets is only one of degree. It's a matter of making up your mind which set you want, assessing the cost and then going to it.

The basic chassis is the same for both receivers, the only radical difference being the picture tube, deflection yoke and the contents of the EHT cage.

First glance at the circuit might suggest that we have made drastic changes but such is not the case. We have merely included, for illustra-

REAR VIEW OF THE COMPLETED 21-INCH TV SET



This rear view of the chassis shows the picture tube mounting and the position of most of the major components. The tube could alternatively be swung in the cabinet as was done in the 17-inch receiver. When this picture was taken, the fitting to hold the yoke against the tube neck was not in position.

tion, component assemblies which were suggested as alternatives in the 17in receiver.

For example, we showed a home-built pentode tuner in the original design, with an appended note that a home-built cascode tuner could be substituted or, if preferred, a commercial tuner.

In this set, we have simply reversed the order; we have installed a commercial tuner and suggested that a home-built tuner could be substituted, if desired.

The same applies for the IF amplifier in the original receiver, we used a "Q-Plus" prefabricated Mark 1 IF strip, with an appended note that a Mark II strip could be substituted, or a home-built version of either, or any other IF strip "giving the requisite gain and bandpass characteristics."

Many readers did use the prefabricated strip but probably just as many bought the necessary components and built up their own, as in the August issue, last. Quite a few, however, have expressed interest in the very inexpensive design using ex-disposals 6AC7s and adopted for our 5in receivers. This interest has naturally quickened in the light of the further details published last month.

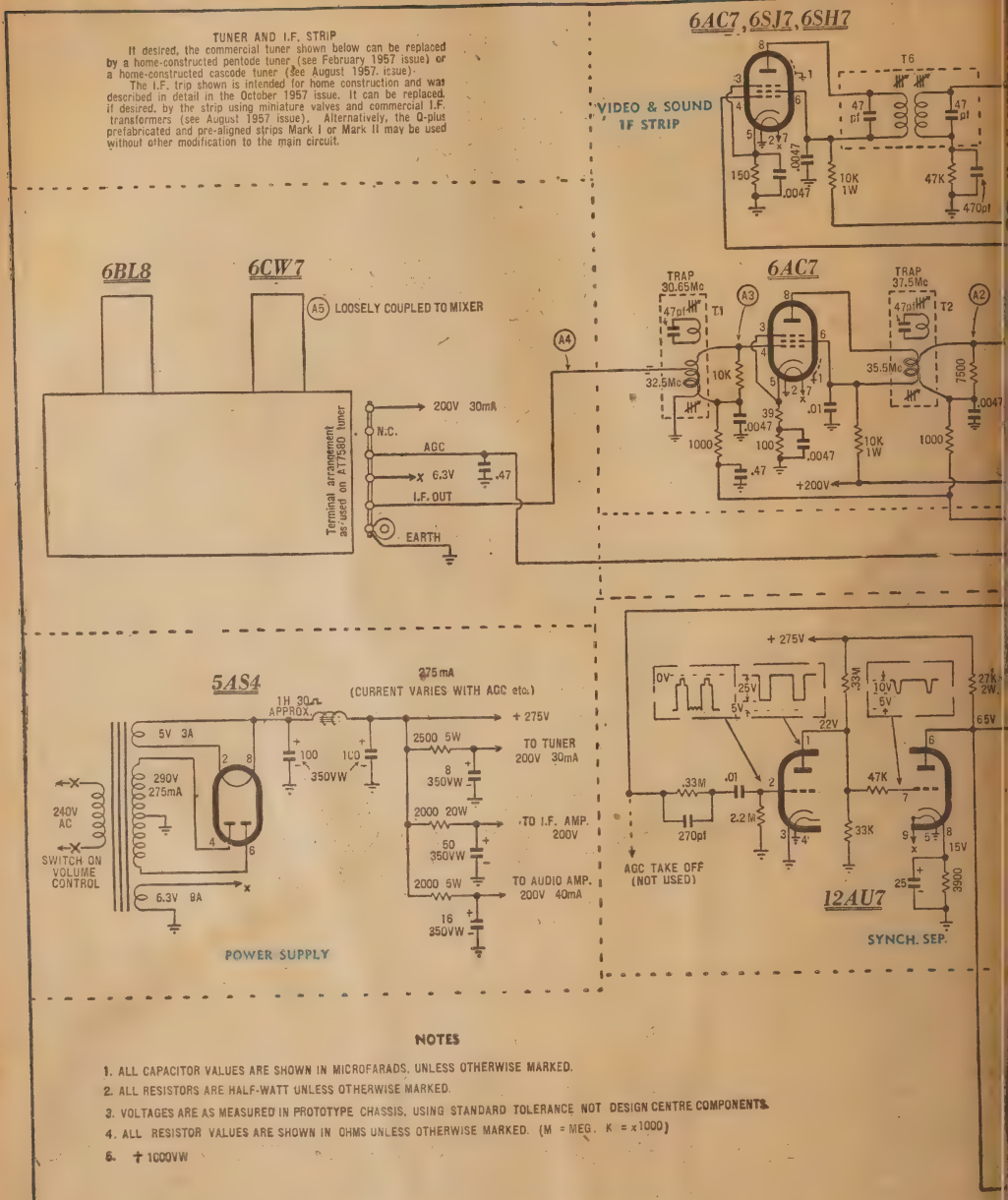
Though using "home-brewed" coils and obsolescent valve types, this IF strip is capable of excellent results and makes possible an immediate saving in total cost. As far as the picture and sound is concerned, there is virtually no difference.

To emphasise the point, we included just such a strip in the receiver, as photographed, and in the circuit. If you prefer to use a prefabricated strip or one with modern valves and unit coils, it is simply a matter of substituting it for the strip shown. External connections remain the same for both.

Audio system, video amplifier, synch. separator and power supply are unaltered.

In the frame circuit, the sole change is the substitution of a 6CM7 for the 12BH7 double triode. The original circuit had been slanted to take care of 21in requirements and the 12BH7 would

CIRCUIT DIAGRAM OF 21-INCH TV RECEIVER WIT



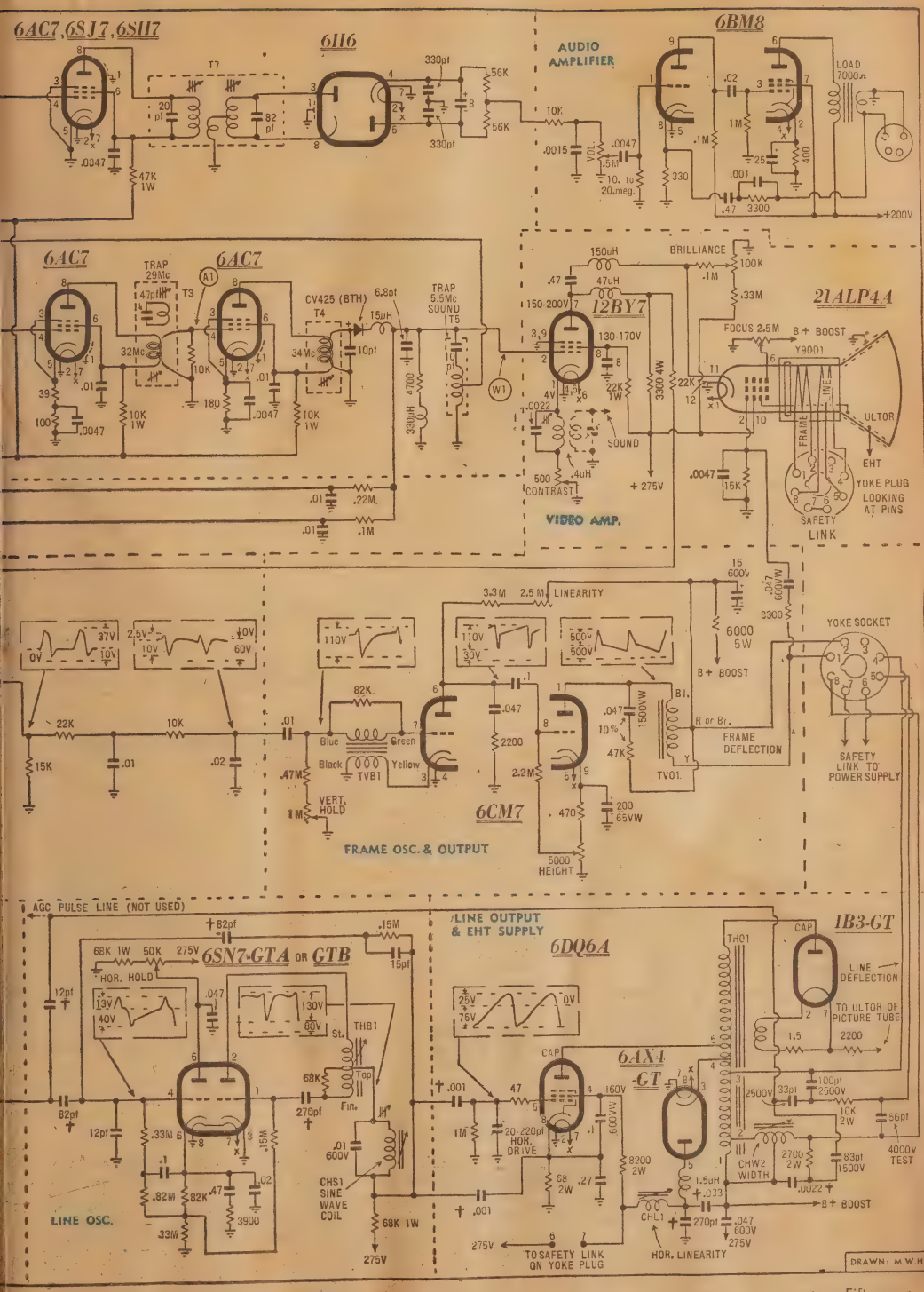
NOTES

1. ALL CAPACITOR VALUES ARE SHOWN IN MICROFARADS, UNLESS OTHERWISE MARKED.
2. ALL RESISTORS ARE HALF-WATT UNLESS OTHERWISE MARKED.
3. VOLTAGES ARE AS MEASURED IN PROTOTYPE CHASSIS, USING STANDARD TOLERANCE NOT DESIGN CENTRE COMPONENTS.
4. ALL RESISTOR VALUES ARE SHOWN IN OHMS UNLESS OTHERWISE MARKED. (M = MEG. K = x1000)
5. † 1000VW

21-INCH TELEVISION RECEIVER

(COMMERCIAL TUNER, 6AC7 IF STRIP, SIMPLE AGC)

ALL IMPORTANT VOLTAGES, AND WAVE FORMS



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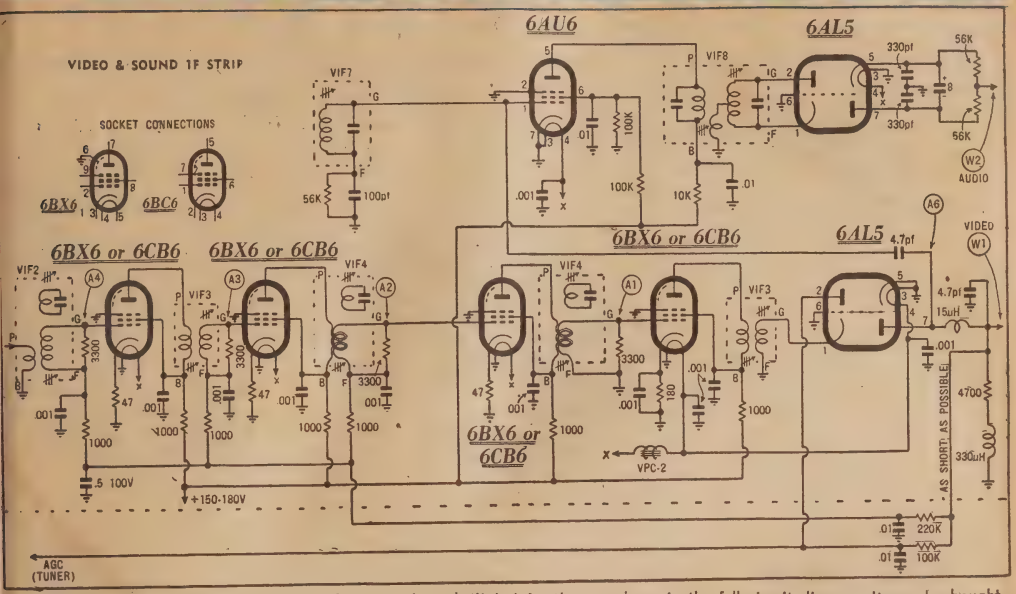
M27A

CIRCUIT OF ALTERNATIVE PRE-FAB. IF STRIP



This I.F. strip, using modern miniature valves, can be substituted for the one shown in the full circuit diagram. It can be bought as a complete prealigned unit or can be home constructed using commercial I.F. transformers. For full description, see the August, 1957 issue.

probably do the job. However, the 6CM7, with revised ratings and pin connections is the recommended type and has consequently been specified.

The line oscillator could be identical with that shown for the 17in set but, again by way of illustration, we have added a modification which uses one or two extra parts but allows a potentiometer to serve as the Line Hold control, instead of the core of the oscillator coil. Either variant can be used with either set, without much influence on the end result.

The one essential difference is in the line output and EHT circuitry, all contained in the EHT cage. The chances are that one could coax enough deflection from the original components to swing a 21in tube and yoke but not necessarily without transgressing tube peak ratings. The obvious course is to use the valves and components recommended for the job.

TUBE MOUNTING

One other point of note is the purely mechanical one of mounting the tube. The method adopted previously was to hang the tube in the cabinet, and this can still be done if you prefer it that way. On this occasion, we show the tube mounted on the chassis, using materials and techniques that will embarrass nobody. They can be applied equally well to a 17 or a 21in tube.

So much for the broad picture. Now for the detail.

The easy way would be to refer back to the 17-inch description for all the basic constructional details except for points of difference mentioned. Unfortunately, stocks of back numbers are so depleted that many prospective builders would be left in the lurch and we must attempt, at least in outline, to cover the whole construction.

The various photographs show the general layout of the chassis, the position of major components and the underneath wiring.

As before, it is recommended that you concentrate on getting the sound section of the receiver into operation first, solving any alignment or other problems in so doing, then adding the picture circuits progressively and checking as you go.

If you use a home-made tuner to the published design, it should slip directly into the chassis cutout and can be held in place by a bracket along one side and a couple of screws and spacers on the other.

Commercial tuners have to be treated on their merits, some being smaller and easier to mount than others. The important points are to get the control shafts in the right position and to avoid having valves or other items poking up into the space where you may later want to put the picture tube. If this latter has to be supported too high above the chassis, it will be less secure and possibly require a cabinet of rather ungainly dimensions.

The tuner pictured on the present chassis is the Mullard type AT7580, for which there is an exact Phillips equivalent.

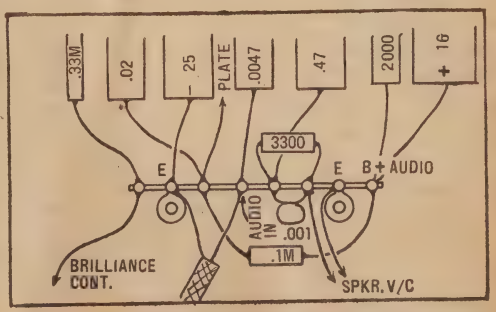
ALTERNATIVE POSITION

If mounted the right way up, the valves would foul the picture tube and we consequently adopted the alternative procedure of mounting the tuner on its side, with the valves pointing horizontally inwards.

The unit should preferably be mounted with the spindles near the top of the cutout in the chassis and as far forward as possible. To do this, some modification is necessary both to the chassis and to the tuner front bracket

☆

A single 8-tag strip wired as shown, will support most of the components to do with the audio system. Wiring for most of the under chassis is either identical with or follows closely that suggested for the 17-inch receiver.



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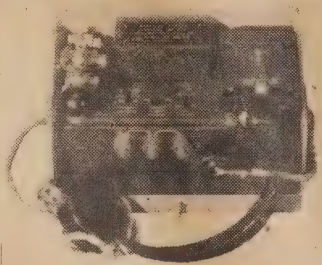

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7/8in.	16	1/9
3/8in.	17	1/-
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¾in.	17	1/9
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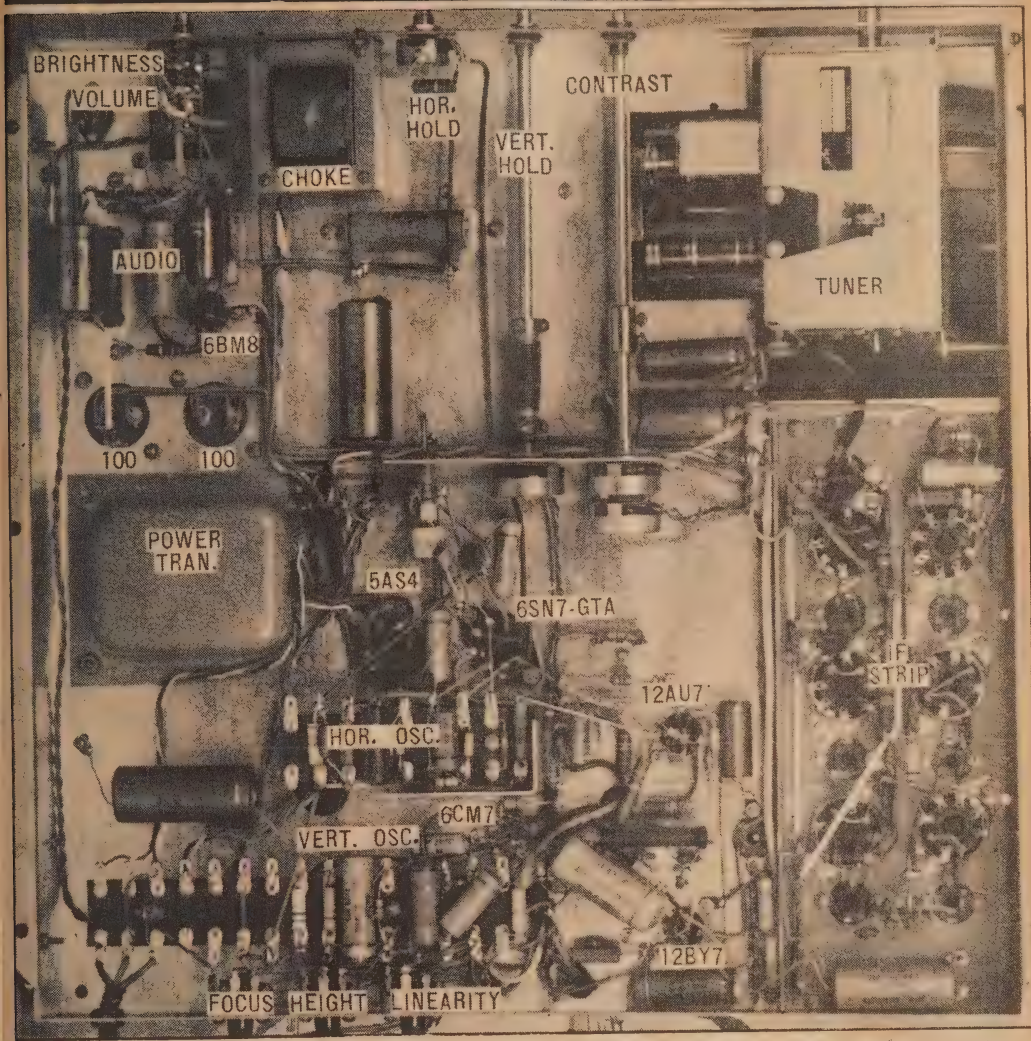
AN UNDER-CHASSIS VIEW OF THE NEW TV RECEIVER



An underneath view of the chassis. Note the position of the tuner and the Line Hold potentiometer, which substitutes for the long shaft controlling the blocking oscillator core. Component layout on the panel at the rear of the chassis has been modified but, otherwise, follows closely on the wiring of the 17-inch receiver.

and this can well be attended to as the first job.

Grip the tuner front bracket in a vyce and trim it back to not more than ¼-inch wide, just wide enough to accommodate a new 1-8th hole and a whitworth nut. The new hole should be drilled through the centre of the bracket and the nut soldered in place to simplify handling.

The existing cut-out in the chassis for the tuner should now be extended by a rectangle measuring 2¼ x 3¼ inches and located about 1 5-16in from the front edge of the chassis. This cut-out provides clearance for the valves in the tuner and allows them to be withdrawn, if required.

Do not make the cutout larger than necessary, or it will weaken the chassis and remove metal which may be needed later to support the picture-tube brackets.

Having made the necessary amendments to tuner and chassis, obtain three 1¼inch (approx.) spacers, with suitable washers and long bolts, drill holes in the side of the chassis to correspond with those in the tuner brackets and mount in position.

Supply and bypass components for the tuner can well be mounted on an 8-tag SM28 strip located, in this case, nearly in line with the edge of the original cutout. Position it carefully so that the end lug, when bent over, clears the Contrast control spindle.

When ultimately wired, this lug and the earthed lug alongside it can well be used as terminal points for the heater wiring, which then jumpers across to the rear of the tuner.

The next lug is a B-plus anchor point and, from it, a 2500-ohm 5-watt resistor bridges to the end lug nearest the tuner. This latter is bypassed to earth with an 8mfd., as specified in the circuit.

The next vacant lug near the tuner terminates the AGC supply lead and is bypassed with a .47mfd. 100V. capacitor. This leaves two vacant lugs to support the 20 or 10 meg. resistors in the clamp circuit, if used.

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MICROPHONE INSERTS

FOR EVERY PURPOSE

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This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**

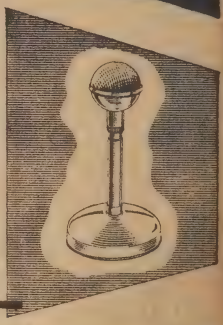
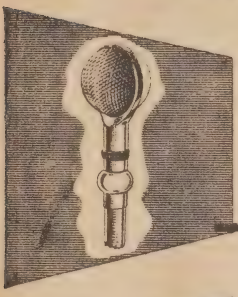


TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE £9/18/6.**



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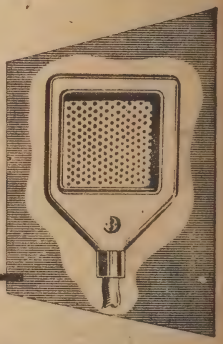
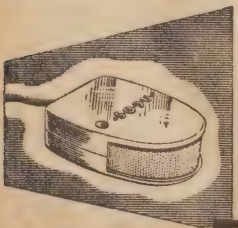
This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6**

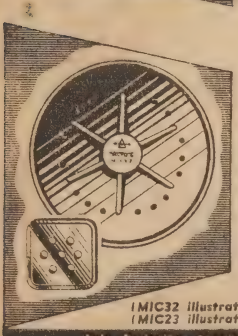


GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substantially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**

HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as ⅛ in. square to 1-⅛ in. round, with various thicknesses from ⅛ in. to ⅜ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg resistor as required.

MIC19/4 and MIC32, **£2/15/6**; all others, **£1/19/6.**

(MIC32 illustrated)
(MIC23 illustrated)

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Following the tuner and mechanical work necessary to fit it, the audio and power supply system can well be wired in.

The transformer, now available in several brands, should be of the low radiation type, designed for television receivers and having the ratings indicated on the circuit.

The total current drain of the new receiver is somewhat higher than the 17in type, by reason of the greater demands by the deflection and EHT circuits.

The actual figure will vary with component values, signal input and contrast setting but, whereas the current of the 17-inch receiver averaged about 250 milliamps, the 21-inch may run a few milliamps over or under the nominal transformer rating.

SAME TRANSFORMER

The figure is mentioned more or less for the sake of the record. All indications are that current type 275-milliamp transformers, as for the 17in receiver, will handle the load without distress and the unit pictured is one of these.

The same remarks apply for the filter choke.

In wiring the transformer, our suggested arrangement is to run the primary wires to lugs on the terminal panel near the rear of the chassis. Other nearby lugs are used to terminate the incoming power cord, the relevant lugs being bridged across directly or by means of the off-on switch, as indicated in the panel diagram.

The off-on switch, by the way, is part of the tandem Brightness-Volume potentiometer, being operated by the Volume shaft.

Wiring to the rectifier socket is straight-forward, but the heater connections warrant special comment.

The total heater drain of a television receiver is considerable and, to meet it, individual transformer manufacturers use separate 6.3 volt windings, or parallel windings with the ends enclosed in a common sleeving or, yet again, a centre-tapped 12.6 volt winding.

Rather than try to terminate the bulky leads at a valve socket, the ends of the wires should be cleaned and tinned and terminated at a small tagstrip alongside the transformer.

With a centre-tapped winding, the tapping can be earthed and the two ends taken to insulated tags. With separate windings, one end of each can be earthed and the other ends likewise taken to separate tags. With a single parallel-wound pair, earth one pair of ends and take the other pair to an insulated lug.

HEATER LEADS

From this point we suggest that you run twisted pairs across to the tuner supply tagstrip, the IF supply tagstrip, the sockets at the rear of the chassis and the tag points supplying the cage.

Use different coloured wires in these twisted pairs and earth the same side of the heater winding at the supply tagstrip to each major section.

The use of a twisted pair may seem rather superfluous at first glance but duplication of the earth points does provide an insurance against any one of them failing due to corrosion. Furthermore, by running separate active wires to each major section, unnecessary voltage drop is avoided.

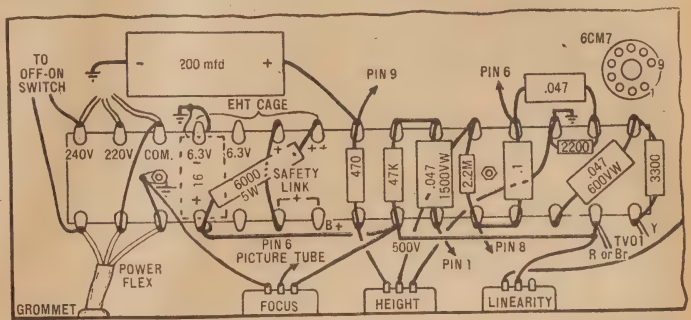
In the case of separate or centre-tapped windings, try to keep the loading on each section about the same.

The filter choke, mounted against the front underside of the chassis, must have the low DC resistance and high current rating, being rather low in inductance as a result. For adequate filtering the 100mfd. electrolytics are essential, these being mounted above chassis, alongside the power transformer

Watch the polarity when wiring these a red spot indicating the positive terminal lug.

or the secondary leads of the output transformer. Connected the wrong way around, the audio system will probably squeal; the right way around should give stable operation with reduced gain relative to the no-feedback condition.

With less than the total drain on the power supply, the voltage may be uncomfortably high and, for initial tests, an odd heavy-duty resistor of 300 to 400 ohms can well be connected between the transformer HT secondary mid-tap and chassis.



This diagram shows the suggested arrangement of components on the panel at the rear of the chassis. The B-plus boost filter components were in the EHT cage, when the photographs were taken but could more logically be placed in the position shown dotted.

Having completed the power supply the audio system, involving a single 6BM8 triode pentode, can logically be wired in next. The exact disposition of the pins in respect to the mounting holes will vary with the type of socket, but the space between pins 1 and 9 should be located toward the side or front corner of the chassis.

The layout and circuit assume the use of an ordinary manufacturer's type speaker output transformer, which will normally have a secondary to match a 2-ohm voice coil. This will cater for any likely speaker, from a 6in to one of the light-duty 12in wide-range types.

If you have more expansive ideas about speaker systems, which incidentally could be open to question for ordinary TV usage, it may be necessary to mount a larger output transformer elsewhere, keep the speaker well away from the picture tube and recast values in the feedback network.

Original Photos

Original, unlabelled glossy photographs of both the 17-inch and the 21-inch receivers are available through query service at the following prices:

8 x 6 inches 5/-
10 x 8 inches 7/-
12 x 10 inches 8/9

Most of the wiring components to do with the audio system can be anchored between the socket pins and a single SM28 8-tag strip mounted in line with the edge of the filter choke. The small accompanying diagram shows the suggested connections to the strip.

When completed, the audio system and power supply can well be tested, using any available source of signal input. The feedback will need to be phased, by switching either the primary

With the audio system and power supply completed and in operation, the next logical step is to wire in the IF channel. Here some explanation is called for.

In the 17-inch receiver, we used a "Q-Plus" Mark 1 prefabricated and prealigned strip. The circuit for this strip was incorporated as part and parcel of the total design.

Subsequently, the manufacturer decided to make the individual coils and transformers available for readers to build their own strip. Many showed an inclination to do so and, in the August issue, we gave complete assembly and alignment data.

ALTERNATIVE CIRCUIT

The circuit only is reprinted herewith for the sake of reference and anyone who is inclined to use this strip, either prefabricated or home-constructed, should have no difficulty in correlating it with the rest of the 21-inch receiver circuit.

Note that a number of components have to be added to the prefabricated strip, as received, including the video diode load and peaking components, a 0.47mf AGC bypass and the AGC clamping circuit, if required.

While this design is stable and efficient, it is possible to save several pounds by building an IF strip around 6AC7 valves (bought ex-disposals) and transformers wound to the data published in our last issue.

To emphasise that this is no "stop-gap" idea, we have shown the strip in the main circuit and photographed in the chassis. If properly built and aligned, it is doubtful whether the user of the set, operating the knobs and looking at the picture, would know which strip was in operation.

A point in favour of the 6AC7 strip, over and above the matter of cost, is its relative ease of alignment with non-specialised equipment. Needless to say

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Round Can — no internal condensers.

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Comb. Video IF & Soundstrip
Part No. 556

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Combination Video — IF. Sound Strip consists of 3 video IF's, 2 sound IF's and 1 ratio detector mounted on combination cadmium chassis. Holes punched for 6AC7 valves. Wound to R. and H. Specifications.

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414	TV noise filter, 2amp.	3/4
415	3uh damper diode choke	3/4
416	4.3uh TV noise filter amp	3/4
417	82uh ratio choke. 1½amp.	IC 3/4
418	10uh video r.f. choke	3/4
419	22uh video r.f. choke	3/4
420	27uh video r.f. choke	3/4
421	33uh video r.f. choke	3/4
422	39uh video r.f. choke	3/4
423	56uh video r.f. choke	3/4
424	68uh " " "	3/4
425	82uh " " "	3/4
426	100uh " " "	3/4
427	220uh " " "	3/4
428	270uh " " "	3/4
429	390uh " " "	3/4
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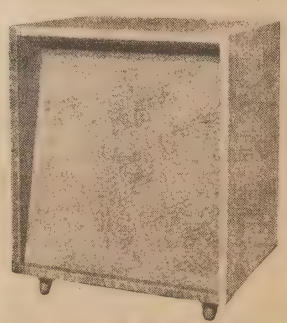

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alignment is more significant to a picture displayed on a 21-inch screen than on the front end of a 5BP1.

In wiring to the strip, we deliberately duplicated the method suggested for the 17-inch receiver, partly to facilitate possible interchange of the 6AC7 strip with the alternative type.

To this end, an SM27 7-tag strip was mounted alongside the rear end of the strip. A lead from the video detector runs across to the rear lug on this strip and thence to the grid of the video amplifier.

From this point a 0.22M. resistor can run to the adjacent lug and an O.1M. to the lug beyond that. These two lugs should be bypassed with small .01mfd. capacitors to the earthed centre lug; leads running away alongside the IF strip to the AGC points supplying IF strip and tuner respectively.

The AGC line for the IF section need not really come outside the strip at all and did not do so in the 5-inch receiver. However, the method of wiring suggested lends itself to any modified system of AGC, which the constructor may choose to add at a later date.

AGC CLAMP

The clamp circuit for the tuner AGC has not been specified with the 6AC7 strip, mainly because it uses a germanium diode and has not a spare diode section "going begging.". In any case, AGC control in strong signal areas is better without the tuner clamp and, even in fringe areas, its role is a very minor one. However, if you want a clamp circuit, you can see how it is done in the 17-inch design.

If a prefabricated IF strip is used, the audio take-off will be at the rear and the remaining blank lugs on the 7-tag strip can be used to support the 10K resistor and .0015mfd de-emphasis capacitor. From here a shielded lead would run right around to the volume control.

With the 6AC7 strip, the audio take-off point is at the front and the 10K resistor is built in it. It is only a matter of adding the .0015 bypass and looping a shielded lead across to a tagpoint and thence to the volume control.

Supply leads for the IF strip, including heater, HT and AGC, along with the audio connection just mentioned, can well terminate at a 5-tag SM25 strip alongside the front of the IF strip. Short links their loop across to the appropriate points within the strip. The shielded audio cable is best earthed at the volume control only.

TV SOUND

Having wired in the IF strip, and coupled it to the audio system and the tuner, the set should be capable of receiving the sound from TV stations. If alignment facilities exist, this is a good time to solve any relevant problems, because the chassis is much lighter and more manageable than it will be with the picture circuits and tube in position.

While the subject of alignment is a vital one, it cannot possibly be discussed further here and reference should be made, if necessary, to the August or October issues detailing the respective IF strips.

Next obvious step is to wire the video amplifier stage, which is just alongside the rear end of the IF strip. The socket should be mounted with the blank space towards the IF strip or the rear corner of the chassis, depending on whether it happens to be a moulded or a wafer type.

Heater, grid and suppressor wiring for the 12BY7 require no special comment. The cathode, however, runs to ground through a sound trap and then a 500-ohm potentiometer. This last is mounted on a bracket beneath the centre of the chassis but its chassis connection should be at the video amplifier socket.

To make up the sound trap you will need a miniature coil can and former with variable iron slug. The winding consists of 6½ turns of 22 B and S gauge enamel wound about 3/8in from the bottom of the former.

The prime purpose of this trap is to produce degeneration and a loss of video gain at the 5.5Mc intercarrier beat, thus minimising interference with the picture. However, it is possible to derive signal from this point to feed the sound IF channel, and a tuned secondary is shown dotted with this possibility in mind.

Several components to do with the 12BY7 plate circuit are mounted on an 8-tag SM28 strip mounted in line with the sound trap coil and parallel with the rear of the chassis. This strip is unfortunately obscured in the underneath photograph by the 3,300 ohm load resistor mounted on it.

Holes are provided for it in the ready-punched chassis although, frankly, we had to re-locate some of these smaller holes in the one we used to keep everything square. The strip should be mounted with the feet towards the 12BY7 socket to give enough room for the components in between.

The tag point at the end nearest the 12BY7 provides the junction between the 47uH choke and the 3,300 ohm resistor. A 22K resistor feeding the synch. separator also attaches to this point.

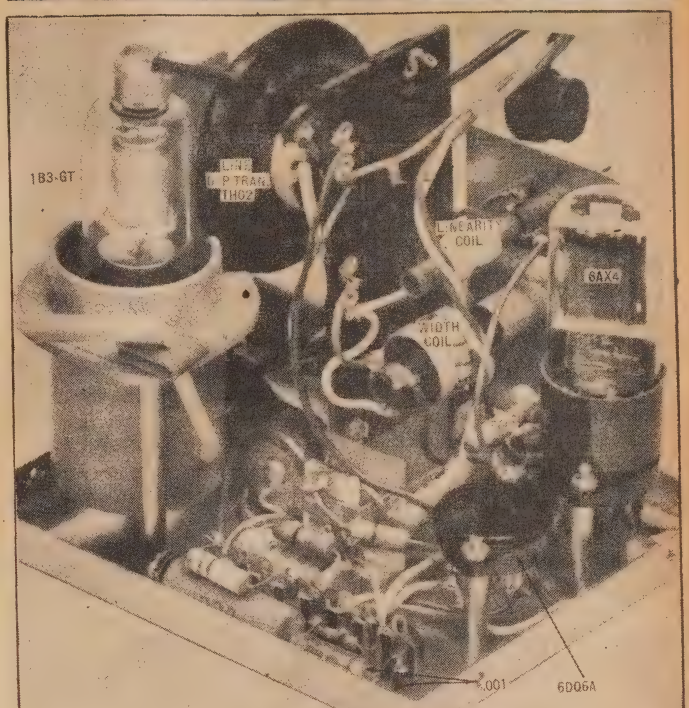
OTHER LUGS

The next lug is "earthy" and the next again provides a junction for the above-mentioned 22K, the .33M and the 270pF capacitor for the synch. separator. These last-mentioned components bridge across to the fifth lug, the .01 capacitor coupling back to the fourth lug and thence to the 12AU7 synch. separator grid.

The sixth lug is for B-plus, providing a feed and anchor point for the 3.3K plate resistor and the 22K screen resistor. Then follows another "earthy" lug, the final one on this strip providing a junction between the 0.5mfd video output coupling capacitor and the 150uH peaking coil.

The 0.47mfd coupling capacitor should not be mounted against the chassis, which would introduce unnecessary stray capacitance. If the leads are cut fairly short it can be supported in mid-air directly be-

COMPONENT LAYOUT — EHT CAGE



This photgraph shows the layout of components in the EHT cage, which uses the same metalwork as the 17-inch receiver. The line output transformer is larger, however and needs to be re-positioned, along with other minor components, to keep it away from the outer shield. The 6DQ6A was removed from its socket for the picture.

RADIOTRON

TELEVISION VALVE SERIES

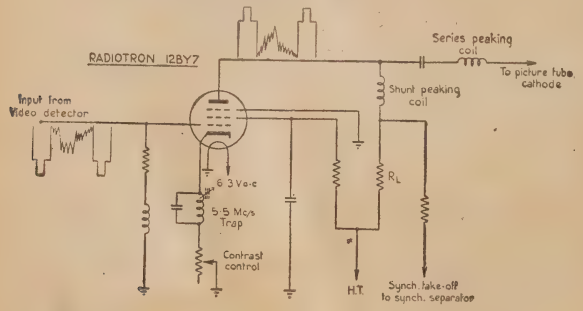
TV VIDEO OUTPUT STAGE

The television receiver video-output stage is required to amplify, without compression, the output from the video detector to a level which is sufficient to modulate fully the electron beam in the picture tube. The level required is normally in excess of 100 volts peak-to-peak. The frequency spectrum of this signal, which includes both picture and synchronising information, can include components extending from 25 c/s to as high as 5 Mc/s.

To maintain the desired pass-band shape a low plate-load resistance is used in association with peaking coils. The higher the circuit capacitance (which consists of the output capacitance of the video amplifier valve, the input capacitance of the picture tube and stray capacitance) the lower must be the load resistance and the more difficult is the practical achievement of the desired gain bandwidth product.

To achieve the necessary gain and output with the low plate-load resistance, a high transconductance valve capable of a relatively high plate current swing is necessary.

A typical video-amplifier circuit is discussed in Radiotronics, April, 1957. A simplified circuit is shown below.

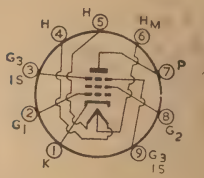


The Radiotron 12BY7 is a 9 pin miniature valve designed specifically to meet the requirements of the video output stage. Its transconductance of 12,000 μmhos enables adequate gain to be realised with low plate-load resistances, and its large signal handling capacity ensures compression-free amplification. The low output capacitance of this valve assists in keeping the circuit capacitance to a minimum, thus facilitating the stage design. The centre-tapped filament enables it to be used with both 6.3 and 12.6 volt supplies.

†For further information on the 12BY7 and other Radiotron Television Valves, consult the TV1 Booklet. Additional copies of this advertisement are available free and post free on request.

12BY7†

SOCKET CONNECTIONS



(bottom view)

Pin 1 — Cathode
Pin 2 — Grid No. 1
Pin 3 — Grid No. 3, Internal Shield
Pin 4 — Heater
Pin 5 — Heater
Pin 6 — Heater Centre-Tap
Pin 7 — Plate
Pin 8 — Grid No. 2
Pin 9 — Grid No. 3, Internal Shield

AMALGAMATED WIRELESS VALVE CO. PTY. LTD.

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VC16.57

tween the 12BY7 plate pin and the lug on the tagstrip.

All connections to the base of the picture tube terminate on a second SM28 8-tag strip, mounted at right angles to the one just discussed. The connections are in the same order as illustrated in the June issue for the 17in receiver.

From the rear of the chassis, the connections are as follows:

(1) Heater, active.
(2) Heater, earthed.
(3) Grid.
(4) Focus electrode.
(5) B-plus.
(6) Cathode, suporting one end of the peaking choke and one end of the 0.1M. return resistor.
(7) Earth.
(8) Other end of 0.1M. resistor mentioned above and the lead to Brightness pot.

PICTURE TUBE

Leads to the picture tube pass up through a grommetted hole and extend about 12in to the socket, sufficient to make easy connection with the base of the picture tube. The leads can be twisted loosely or enclosed in large diameter spaghetti tubing — except for the lead to the cathode. This should be no longer than necessary and kept well in the clear.

From the video amplifier, portion of the signal is diverted to the 12AU7 synch. separator stage. The components involved have already been mentioned and merely require to be connected across to the socket.

You will note that we have changed the value of coupling capacitor to the synch. separator from .0022 to .01mfd. Indications are that a longer time constant is desirable in this circuit and may correct a tendency there has been in some receivers for slight bending at the top of the picture.

Most of the components to do with the actual valve operation can be grouped around the socket, bridging as necessary to adjacent earth and B-plus points. The socket should be mounted, by the way, with the space between pins 1 and 9 toward the IF strip.

TO OSCILLATORS

The differentiating and integrating components feeding respectively to the line and frame oscillators are terminated on a seven-tag strip mounted to the left of the synch. separator socket. With one exception wiring follows the practice in the 17-inch receiver but is listed again for reference.

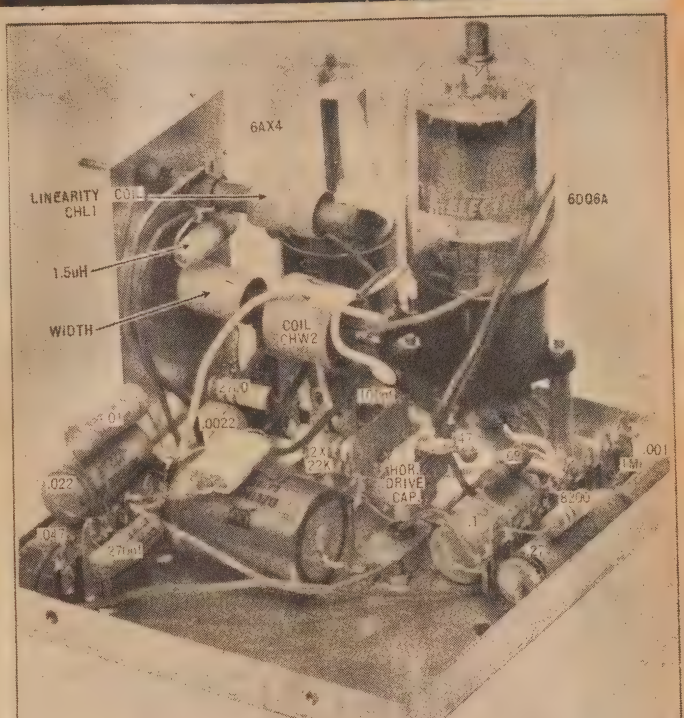
The end lug, nearest the front of the chassis (top of the picture) is the junction point for the 82 and 12 pF capacitors and from it a lead runs across to pin 4 of the 6SN7GTA socket.

The next lug provides the junction for the 22K and 10K resistors forming the integrating network, the 10K bridging to the adjacent lug. These two points are bypassed to earth by small .01 capacitors.

From the end of the 10K resistor a .01mfd. capacitor bridges past the "earthy" centre lug of the tagstrip to lug 5, which thus becomes the termination of one lead from the frame blocking transformer, an 82K resistor and a lead to the 0.47 M resistor in the frame hold circuit.

This latter resistor, by the way, is mounted on a separate three-tag strip near the frame hold control.

ANOTHER VIEW OF EHT CAGE



We removed the line output transformer and EHT socket to get this picture of the wiring components. The B-plus boost filter components in the foreground have since been transferred to the main chassis, which relieves congestion to some extent.

The free end of the 82K resistor just mentioned joins to lug 6 on the seven-tag strip, which thus becomes an anchor point for the "grid" connection of the frame blocking transformer. The colour code for this transformer appears to have been changed, by the way, and the circuit has been endorsed with possible alternatives.

Lug 7 forms an anchor point for the 3.3M resistor which is part of the frame linearity adjustment. This resistor was shown as 2.2M in the previous circuit, but experience has shown that the higher value is preferable in most cases.

For the frame oscillator-output stage use a good quality moulded socket fitted with a shield for the valve itself. Mount the socket with pins 1 and 9 toward the IF strip and avoid careless use of flux when wiring. Note that this socket is isolated from the line circuits by a small shield partition, evident in the photograph.

Most of the components to do with the frame oscillator and output sections are mounted on the panel near the rear of the chassis. This has been rearranged considerably in respect to the 17-inch receiver and the accompanying layout sketch should be helpful.

As mentioned earlier, this panel also provides terminal points for the power transformer primary winding, supply wiring to and from the EHT cage, connections to the safety link in the yoke and the B-plus boost filter components.

LINE OSCILLATOR

The last major section of the underchassis wiring is the line oscillator and control valve, 6SN7GTA. This requires an octal socket, mounted with the keyway towards the front of the chassis.

The blocking oscillator coil associated with it is mounted in the same bracket which carries the Contrast and Frame Hold potentiometers.

In the 17-inch receiver an extension spindle operating on the core of this coil serves as the Frame Hold control. This same idea is used in several commercial receivers but, by making slight changes in the circuit constants, we have rearranged things to allow a potentiometer at the front of the chassis to serve the same purpose, thus avoiding a mechanical difficulty.

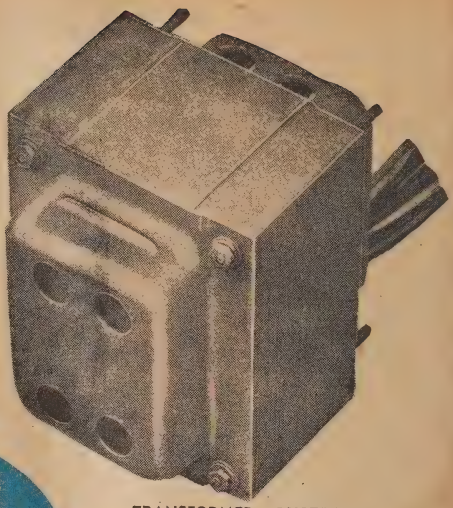
The sine wave coil occupies its original position, mounting vertically beneath the chassis.

Lack of space does not permit connection details to be given here for these two coils or for other deflection components used in the EHT cage. The information is given, however, in the Radiotron TVI booklet available from the Amalgamated Wireless Valve Co

Used in this month's
"Radio Television & Hobbies"

21" TV RECEIVER

specify—

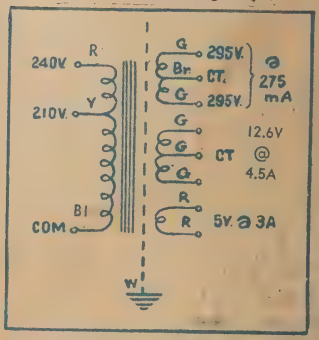


National
POWER TRANSFORMER

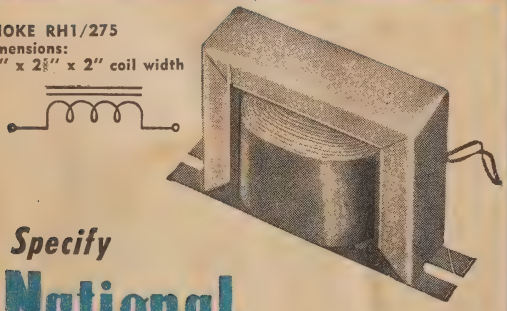
RH275/295

for these 8 reasons—

TRANSFORMER RH275/295
Dimensions (upright mounting)
4½in x 3½in, chassis height 4½in.



CHOKE RH1/275
Dimensions:
3⅛" x 2⅝" x 2" coil width



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TECHNICAL FEATURES

2 Designed to operate at low flux density thus reducing interference in picture tube.

3 Electrostatic shield between primary and secondary minimise line pick-up.

4 Fitted with copper strapping to reduce external field.

5 "Rolled-edge" holes in cover prevent chafing of leads.

6 Unique lead-anchoring inside the core prevents leads being pulled out.

7 Air-cooled scientifically. Louvres and vents in the cover provide maximum cooling.

8 Low temperature rise reduces the ambient of the T.V. receiver chasis.

RETAIL PRICE 206/9

Pty. Ltd. (3/6 posted) at 47 York St., Sydney. Alternatively, data sheets can be obtained from Manufacturers Special Products, at the same address.

In wiring the stage, the 270pF grid capacitor swings between the valve socket and the blocking oscillator coil, while the 68K resistor mounts directly on the coil, between the appropriate terminals. The .01mfd, which should ideally be of a low tolerance type, likewise mounts directly across the terminals of the sine wave coil.

WIRING COMPONENTS

All other wiring components are mounted on the resistor panel supported alongside the 6SN7GTA and 5AS4 sockets. For the sake of identification, the two lugs at the end nearest the 6SN7 socket can be numbered "1", progressing through 2, 3, 4, 5, etc. towards the other end.

The capacitor between the number 1 lugs is the 12pF mica which feeds the line output pulse from the output transformer back to the plate of the synch. separator. The line carrying this pulse runs from the grommeted hole leading to the cage, straight to the capacitor and thence across to pin 6 of the 12AU7 socket.

The line oscillator grid resistor mounts between the number 2 lugs, the one nearest the valve socket connecting directly to pin 1.

Between the number 3 lugs is the .33M input grid resistor, with the end nearer the socket bridged to pin 4. The other end connects to the .05 (or .047) capacitor, running across to lug 4 nearer the socket and thence to the valve cathode pin 6.

From this point, an 82K bridges to lug 4 furthest from the socket, the .82M resistor shown in the circuit mounting between the adjacent lugs 3 and 4.

A .33M resistor mounts between the number 5 lugs, the one nearest the socket being earthed. From this latter earthed lug, a .02mfd. capacitor bridges to the adjacent lug 4.

OTHER LUGS

An 0.5 (or 0.47) capacitor is supported across the number 6 lugs, a 3900 ohm resistor running from one of these lugs back to the earthed number 4 lug, already mentioned.

The number 7 lugs and number 8 lugs carry respectively an 82pF. capacitor and 68K resistor, the 0.15M resistor and 15pF shunt capacitor in the pulse feedback network bridging between them.

Wiring this panel is a rather tricky business and we suggest that it should be sketched out beforehand and the positions of components and leads worked out in relation to the circuit. It can then be wired up with a minimum chance of error.

This panel, by the way, like the panel carrying the frame components, can be supported about an inch from the chassis (1¼ in the original) on spacers or long bolts.

Purpose of the line oscillator is to supply a drive voltage, locked with transmitter line frequency, to the line output stage.

The drive voltage is developed principally across a .001mfd. capacitor running to line output valve cathode. This is both timing capacitor and a bypass and the line oscillator circuit will not work reliably without it. To test the line oscillator, without the cage in position, it is essential to bypass to earth temporarily the junction of the 68K resistor and the sine wave coil.

As indicated in the circuit diagram, all components to do with the line output stage and EHT supply are housed in the metal EHT cage above the chassis. This is dictated partly by mechanical necessity, partly for reasons of safety and partly to confine the energy associated with the line deflection circuits.

All components are assembled on to a base-plate measuring approx. 6 x 5 inches, with a half-inch flange upturned to support the top cover. This latter is a tight push-fit but is intended to be held in place by four self-tapping screws.

The line output transformer and width coil for 21-inch deflection are larger than for 17-inch but can still be housed in the same metal box, provided a few slight amendments are made.

Firstly, the angle bracket on the line output transformer, on the side remote from the terminal lugs, should be reduced to ½-inch wide, just enough to drill a new mounting hole for an 1/8th inch bolt.

As before, a couple of pillars will be needed to support the skirted EHT rectifier socket about 5/8-inch above the base-plate. However, do not mount it immediately in the existing holes but elongate the holes, if necessary, to bring the socket right over to the side of the cage.

LINE TRANSFORMER

The line output transformer should now be slipped in alongside it, with the EHT coil fitting into the existing cut-out in the bakelite flange. Actually, this cutout can be enlarged somewhat and extended into the vertical portion to allow the EHT coil to come as close as possible to the EHT rectifier and as far as possible from the side of the cage.

At the same time, the coil supporting bracket should be kept hard against the end of the base-plate, so as to leave as much room as possible for the width and linearity coils.

Having determined a position for the line output transformer, drill the necessary holes and mount it temporarily in place.

The linearity coil can mount directly in the topmost hole in the rear support bracket but the width coil, which is larger than the 17in version, can well be mounted to one side of the original position and clear of the loop feeding the EHT rectifier filament.

The horizontal drive capacitor and its mounting may have to be shifted slightly from its original position but this will involve nothing more than a couple of extra mounting holes. Keep the screw in line with the adjustment hole in the rear plate and make sure that the capacitor is opened up to minimum capacitance before it is finally placed in position. The chances are that it will remain this way.

To support the minor components, three tagstrips are used.

An 8-tag SM28 strip along the front of the baseplate supports the components to do with the line output valve and is wired in much the same way as for the 17in receiver.

A 7-tag strip, slightly trimmed, will mount with nothing to spare between the feet of the line output transformer. This will carry most of the components to do with the B-plus boost circuit, again in line with the wiring of the 17in receiver.

Another 7-tag strip, mounted between the valve sockets and the line ouput transformer carries the high voltage capacitors and associate resistors to do with the deflection output circuit.

Space is not available this month to detail the individual connection points but what has been said should serve as a guide for anyone who may reach the stage of wiring up a 21in cage before the next issue appears. The two coded photographs, though necessarily rather hard to follow in detail, should be a further help.

Next month, we should be able to add the necessary wiring instructions with some general hints and tips about getting the best out of your receiver.

We plan also to include detailed instructions for mounting picture tubes on the chassis, as illustrated at the head of this present article.

GENERAL GUIDANCE

By way of general guidance, in the meantime, the strap around the tube faceplate was bent up from a standard aluminium beading measuring approximately ¾in by 1/8in overall. It can be formed around the edge of the tube itself, then bent at the ends to accommodate a 3/16in bolt, acting as a clamp.

Allow a small amount of slack in the clamp so that a strip of 1/8in rubber packing can be inserted between the metal and the glass.

Next bend up a U-bracket from 16-gauge aluminium to support the bottom of the tube clamp about 1 5/8in above the chassis and about 1 7/8 back from the front edge. These are the dimensions used in the original set but they may be affected by the way the receiver is fitted ultimately into the cabinet.

A full 6ft length of ¾in aluminium is needed for the clamp just described and a further length of wider moulding — in our case 1 1/8in — is required to provide the vertical and sloping supports for the clamp, as shown in the photograph.

NO EXTRA SUPPORT

If the bracket work is done carefully, there will be no need to provide any additional support or stabilisation at the neck of the tube. It is simply a matter of slipping the yoke into place and holding it forward against the glass by means of a back plate and a couple of springs attached to the support brackets.

The centring magnet and ion trap clip directly to the glass and do not need other support.

Another point to remember is that the coating on the outside of the tube bulb must be earthed and a suitable method of doing this is to stretch a length of braid from shielded wire obliquely across the bulb. Attach one end to the apex of the bracket work and attach the other through a light spring to the opposite bracket.

Let's Buy An Argument

Way back in September, 1950, we started these columns with an outburst about direct coupling. Many and varied have been the subjects covered since. But now, seven years later, we're back on the same thing—direct coupling!

by Neville Williams

HOWEVER, there's a difference. In 1950, it was direct coupling in audio amplifiers; in 1957, it's direct coupling in video systems, and strangely enough, we're temporarily on the same side of the fence.

Let me tell you a sad, sad story.

A few weeks ago a certain training establishment, which had best remain nameless, set an examination question for the students which read something like this:

"Sketch the circuit of a video amplifier from detector to picture tube, including compensating circuits and brightness control. Show the composite signal oscillographs you would see at the input and output."

Now a number of the students sailed right in and sketched out circuits either similar to or identical with the video stage in the "R., TV and H." 17inch receiver. It was fresh in their minds because some of them, at least, were building the set.

Did they get full marks?

No sir, they did not. They were "docked" because they showed an AC coupled video amplifier without DC restoration!

Now, come, come, Mr. Examiner. What possible grounds could you have for adopting such an attitude? I fear you might have very great difficulty in justifying it.

Can it be that you believe "AC coupling" to be an impractical scheme? One that won't work?

I can assure that it works very well indeed in our 17-inch receiver. This goes for the prototype and for the hundreds of copies which have since been made of it. In our meanderings around commercial sets, we've seen lots of worse pictures, some as good as, but very few better than!

Oh yes, it works.

Perhaps, Mr. Examiner, you don't like "AC coupled" video amplifiers?

Well, you're in good company and perfectly entitled to your opinion. The subject of capacitive versus directly-coupled video amplifiers is a complex one and wide open for debate.

But is a mere difference of opinion fair ground for docking marks?

Perhaps the submission of a capacitively coupled amplifier dodges some of the tricky points you had intended to pose to the examinees?

Maybe it did, but it's a bit late to make the point after the question has been set and answered.

There's an old saying, you know, about closing the gate after the equine quadruped has made his or her rather unexpected departure!

THE THING TO DO

If you didn't like capacitively coupled video amplifiers or didn't want the examinees to sidestep certain complications of direct coupling, then surely the right and proper thing was to insert the words "directly coupled" into the original question.

In the absence of such words, your perspiring trainees were surely within their rights to submit any circuit which appeared to meet the stated requirements —unless it could be shown that such a circuit was out of date or impractical or non-typical.

Then, Mr. Examiner, you might have justifiable grounds for rejecting it. But what is the position?

Locally, some receivers use direct coupling, some capacitive coupling and some, I understand, employ circuitry, which is readily adaptable either way. I haven't seen any analysis, but gather that direct coupling currently predominates, with some designers having "second thoughts" on the subject—both ways!

The overall position in Europe is not very clear, but generally favours direct coupling.

POSITION IN AMERICA

American figures, however, are rather startling. About twelve months ago, a breakdown of circuit practice suggested that 90 per cent of all American receivers used capacitive coupling. The last figure I heard, just recently, indicated that only 3 per cent of current American receivers used direct coupling or DC restoration.

The rest? Capacitive coupling.

And since there are far more television sets in the Americas than in all the rest of the world put together, it looks very much as though direct coupling runs a bad second in terms of general usage.

I'm afraid, Mr. Examiner, that if your

ecision was on this basis, you owe it to
ne class to recall all papers and reverse
our marking procedure.

As it happens, I understand that the
xamination was not a vital one and
obody is terribly worried about it.

But naughty, naughty. Let's hope it
oesn't occur again!

By this time, readers who aren't im-
ediately au fait with television cir-
uit practice are probably wondering
hat this is all about. We'll do our best
o put you in the picture.

The instantaneous strength of the car-
ier radiated by a television station is
upposed to be strictly proportional to
he distribution of light and shade across
he image being scanned.

With negative modulation, the black
evel is equivalent to about 75 per cent
f the peak power radiated on synchro-
isation pulses. White is about 12 per
ent and varying shades of grey produce
arrier strengths proportional between
hese limits.

DETECTOR VOLTS

In the receiver, the incoming signal
s rectified by the detector which pro-
duces, across its load, a voltage which is
nstantaneously proportional to carrier
strength. A "black level" carrier pro-
duces so many volts, a "white level"
signal proportionately less, with varying
shades of grey in between.

The variation in voltage across the
diode detector load, with signal, is
normally insufficient to modulate the in-
tensity grid of a picture tube, so that at
least one stage of video amplification
must be interposed between the two.

If direct coupling is maintained be-
tween the detector load, video amplifier
and picture tube, any given order of
carrier level can maintain a certain volt-
age at the picture tube grid (or cathode)
for an indefinite period of time.

The screen can be held completely
black or completely white or at any in-
termediate tone for as long as the pro-
gram producer at the station desires. At
first glance, this might appear to be the
proper arrangement and the only one
worthy of consideration.

The use of a directly coupled video
amplifier is not without its problems,
however.

D.C. POTENTIALS

Initially the designer has to reconcile
the progressive D.C. potentials in the de-
tector, amplifier and picture tube cir-
cuits, so that favourable operating con-
ditions are preserved with any signal in-
put or control setting, or with any likely
variation in components or mains voltage.
The requirement is something of a
nuisance but can be met.

A more serious problem arises from
the fact that any attempt to control
"Contrast," by varying video gain,
usually affects operating currents or
voltages in the video chain. This alters
the bias level on the picture tube and
changes the apparent picture brightness
as well.

To the non-technical user, interaction
between Contrast and Brightness controls
can be very confusing and, unless a cer-
tain "two-fisted" skill is acquired, the
final settings may end up as anything but
optimum.

The position is complicated still further
if the A.G.C. system in the receiver can-
not maintain a constant peak signal volt-
age across the diode load. Brightness is
then affected by the Channel Selector, by
the Fine Tuning control, by the Contrast
control and—of course—by the Bright-
ness control.

In all innocence, the prospective buyer
may be excused for saying, "I don't like
that set—it's too hard to tune."

Nor does the difficulty end there. It
gets right back to the TV station itself.

Because of the strict DC coupling, the
brightness level at the picture tube face,
once set, is thereafter governed by the
brightness characteristic of the signal
radiated by the station. If it is down, for
any reason, the picture looks dim. The
reverse is likewise true.

Now the picture brightness from the
station should be very carefully con-
trolled at all times, so that it is notably
high or low only when the situation de-
mands it. But this ideal is not always
realised.

In America, I understand, the stan-
dard of monitoring from the majority of
stations is not good, simply because there
aren't enough personnel on the staff to
preview and classify program sources
and preset levels. Once on the air, the
operating personnel may or may not be
quick to correct errors of brightness and
contrast.

The result? Viewers are annoyed be-
cause their sets seem to vary unduly in
brightness from subject to subject.

The same problem seems to exist in
other countries to varying degrees, al-
though I have heard Western Germany
credited with operating standards which
are second to none in this respect.

WOULD AN ALPHA BETA GAMMA?

Dear Sir,

May I offer a bouquet in one hand and gently drop a brickbat with the other?

We have recently installed a TV receiver here and I obtained a copy of your December, 1956, issue to look up details of the fan antenna. This has been duly constructed and at this location, about 35 miles by air from Dandenong and situated among mountains, the "R. TV and H." antenna is doing a wonderful job on all channels—ghosting is nil even with the antenna installed indoors suspended from the ceiling on wire.

So much for the bouquet which is offered in good faith.

However, whilst browsing through this particular issue of the magazine, I note a reply in your feature "Here's Your Answer, Tom" on page 63. It deals with rays and radiation. There in is stated—

"Alpha and beta rays which are also emitted by radio-active substances, are more penetrating than gamma rays."

As the Radiac Officer at this establishment I take you to task. From a nuclear explosion a number of radiations take place. If you extend the definition of "radiations" to include the dispersal of sub-atomic solid particles as well as those of an electro-magnetic nature then alpha and beta may be considered, but in so doing, neutrons cannot be disregarded.

All these emanations, whether electro-magnetic or particulate, are functions of radio-activity—which can be defined as the state in which a substance disseminates energy in the form of gamma rays or throws off sub-atomic particles or does both.

To return to your statement:

Both alpha and beta radiation are particulate—both are more ionising than gamma radiation and can thus cause more damage to body tissue. but more penetrating, NO.

In their passage through matter, alpha particles produce considerable direct ionisation and thereby rapidly lose their energy. After travelling a certain distance, known as the "range," an alpha particle ceases to exist as such. (In effect it captures two electrons and becomes a harmless helium atom.)

The range depends on its initial energy but even those from plutonium, which have a fairly high energy, have an average range of just over 1½ inches in air. In dense media such as water or body tissue the range is even less, being about one thousandth part of the range in air. Consequently, alpha particles from radio-active sources are unable to penetrate even the outer layer of skin.

With regard to beta particles, they, like alpha particles, are able to cause direct ionisation in their passage through matter. But the beta particles dissipate their energy less rapidly and so have a greater range in air and in other materials.

Many of the beta particles emitted by fission products travel a total distance of 10 feet or more in the air before they are absorbed.

However, because the particles are continually deflected by electrons and nuclei of the medium, they follow a tortuous path, and so their effective (or net) range is somewhat less.

The range is somewhat shorter in more dense media and the average net distance a particle of given energy can travel in water, wood, or body tissue is roughly one thousandth of that in air.

It would appear that even moderate clothing provides a substantial attenuation of beta radiation, the exact amount varying with the weight and number of layers.

Returning to gamma radiation, gamma rays have a range in air of several thousand feet, the exact range being mainly determined by the initial energy. However, to take even as low an initial energy as 0.7 Mev per photon, which is roughly the average energy from fission products, gamma rays of this energy have such penetration that it requires 3 to 4 inches of concrete to produce an attenuation of 50 per cent.

Bearing the foregoing facts in mind, I venture to suggest that you might agree that the statement in the December, 1956, issue is fallacious. The facts can be substantiated from many authoritative sources.

(C. T. Macedon, Vic.)

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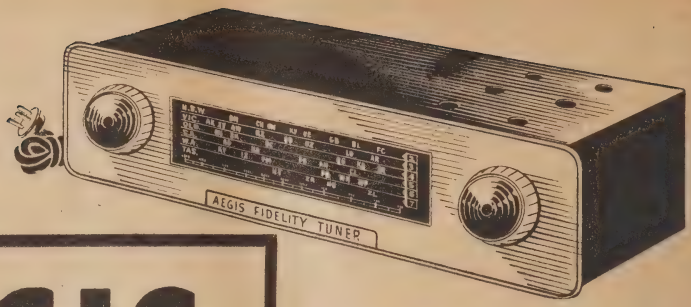

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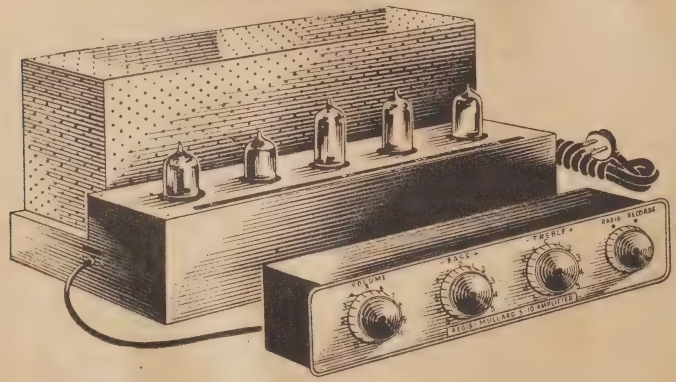

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Locally, the hope has been expressed in technical circles that Australian stations would likewise be above criticism but there are indications that such hopes are not being realised. On several occasions lately, I have heard receiver engineers express dissatisfaction with the state of things. Frequently, they say, they have to choose between getting up to readjust the brightness or else sit it out until a change of subject or someone at the station puts things right.

Is the American pattern going to be repeated here after all?

But where does capacitive coupling fit into all this, or "AC coupling," as it is frequently called?

COUPLING CAPACITOR

Well, AC coupling simply involves the substitution of a conventional resistance-capacitance coupling network in the video chain, usually between the video amplifier plate and the picture tube cathode. The two stages thus become independent as far as DC levels are concerned. The initial problem of reconciling voltages and operating conditions is obviated, along with accumulative effects of component aging and mains variation.

Contrast control can be effected in the video amplifier circuit without disturbing the picture tube potentials and average picture brightness therefore becomes purely a function of the brightness control.

If the measured voltage across the diode load should vary with signal, it may affect the video amplifier but, once again, it does not react on average picture brightness. As far as the user is concerned, the controls do only what they're supposed to do—vary tuning or brightness or contrast, without obvious interaction.

Can the non-technical user be blamed if he says, "I like that set because it is easy to tune."

And last but not least, he doesn't have to keep readjusting brightness if station monitoring falls short of the mark. The average brightness stays where he puts it—even with no picture on the screen at all!

What actually happens is that pictures which are too dark or too light or just right, or signals which are stronger or weaker, are all averaged out to the one brightness level but with varying degrees of contrast—too much, too little or just right.

BRIGHTNESS v. CONTRAST

At first glance this might simply imply that you have to vary the contrast rather than the brightness knob but it doesn't work out quite that way. One can tolerate a picture which stays bright but temporarily lacks contrast much more than one which erratically flares or goes dull.

Taken all round, a receiver which has unambiguous controls and produces constant average brightness might easily have greater popular appeal than its opposite number.

That's the way it has worked out in America and that's the way it might easily evolve here.

Are there no catches? Well, yes, there are.

Because an AC coupled receiver insists on maintaining constant average brightness, it will simply not reproduce properly scenes in which a few odd highlights appear against an otherwise black screen.

Figure 1: Structure of the well known Benham's top.

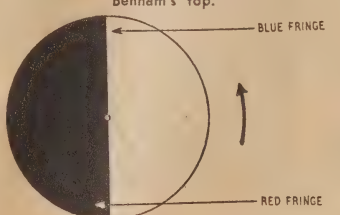

Figure 2: Simple top used by Helmholtz to demonstrate subjective colours.

Those gangsters in the truck cabin, racing through the night, are seen against a grey, not a black background. The bush beyond the flickering light of the campfire isn't quite as dark and eerie as the producer intended it should look. And those film fades, which usually black out the screen, only "grey" out.

As for the rest, all the ordinary scenes that fill the screen for 99 per cent of the time, you'll never pick the difference.

How do I know? Well, I've been watching the "R. TV and H." receiver for quite a few months now and it uses AC coupling. What's more, I haven't any urgent inclination at present to change it over to direct coupling. It gives a good picture, it's always bright enough and every control does no more nor less than it's supposed to do.

I said that before, admittedly, but it makes things a lot easier for my strictly non-technical family!

Oh, yes. Before blaming local stations for bad monitoring if the brightness of your direct-coupled set does vary erratically, give a bit of thought to your set's A.G.C. system.

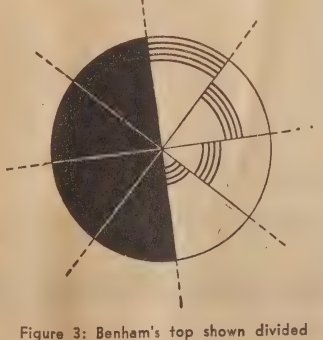

Figure 3: Benham's top shown divided into eight segments.

I haven't heard this point discussed at length but the voltage from a simple A.G.C. system varies with picture content and it cannot in any case hold constant the peak signal voltage across the detector diode load.

Therefore, many of the comments one hears about stations radiating "good blacks" or "poor blacks" or different degrees of contrast or varying amounts of brightness may simply be due in large measure to the reaction of an elementary A.G.C. system through a direct coupled video amplifier.

A.G.C. SYSTEM?

Maybe it is bad practice to use direct coupling in any set which does not also incorporate a fully amplified and gated A.G.C. system.

Maybe the more practical answer for sets with simple A.G.C. would be A.C. coupling with a strategically located D.C. restorer. But why labour the point further just now.

I think I've said enough to indicate that the subject can't be dismissed with the flourish of a red pencil—the docking of a few marks from an exam paper.

Grrrr! The brute!

Changing the subject rather abruptly, you may remember that I raised the question in an earlier issue about reports from England of colour phenomena observed on their conventional black and white receivers. I was at a loss to know at the time whether the reports were fanciful or garbled or related to some deliberate experiment.

The answer is contained in the latest issue of "Wireless World," which carries an article by C. E. M. Hansel, M.A., of the Department of Psychology, University of Manchester. He reveals that the experiments were based on known physical phenomena, whereby the eye registers a colour sensation when presented with certain moving black and white patterns.

NATURE OF PROBLEM

The explanation doesn't appeal to me as a very lucid one but it does indicate the general nature of the phenomenon, if one can call it that.

It also seems likely that the same kind of sensation can be produced accidentally and this may explain some of the reports we have had of colour sensations from local TV sets and programs.

I'm not referring in this to the basic colour of the tube fluorescence, which can be anything from a bluish white to a near sepia. I refer to individual scenes and patterns which reportedly seem to take on definite tints for longer or shorter periods. I can't claim to have seen the effect personally but three other members of our staff, who are not given to excessive tippling, claim to have done so.

Perhaps others have noticed these colour effects. What follows is a direct quote from C. E. M. Hansel and his article "Subjective Colour for Television."

I quote:—

"It is well known that people watching certain television 'commercials' on ITV have observed colour effects on their receiver screens. As the same colours were reported by a number of independent

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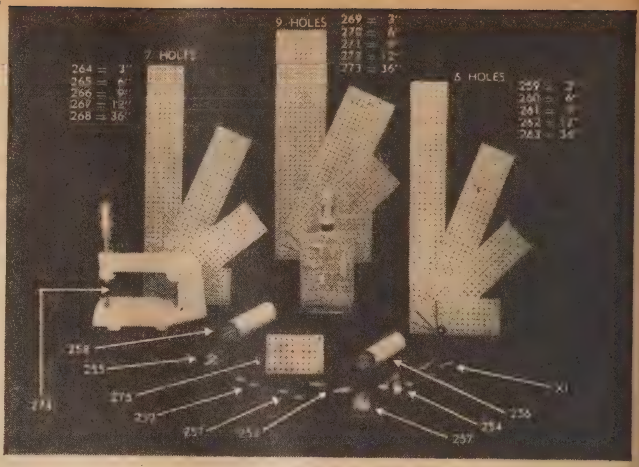

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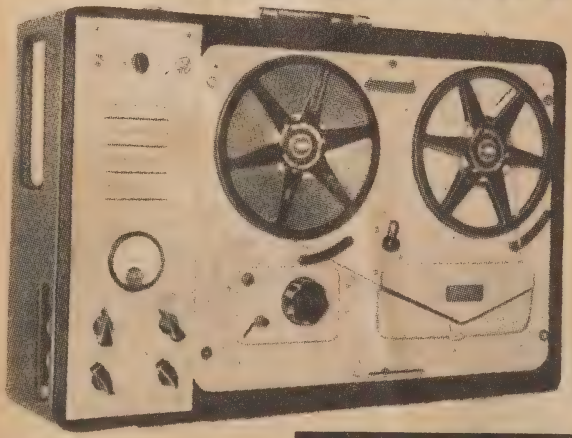

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observers there is no reason to doubt that they did experience sensations of colours, and it is of interest to see how these could arise.

"It has long been known that colour sensations can be aroused by viewing a black and white top rotating in white light. Benham's top (fig. 1) is the best known means by which these colours can be produced. If Benham's top is rotated in monochromatic illumination from the middle part of the spectrum it is still possible for an observer to experience a variety of colours.

"The effect was demonstrated by Helmholtz. He showed that if a simple top (Fig. 2) in which one half is black and the other white is rotated, there appears to the observer to be a blue fringe behind the black as it leaves the white area and a red fringe extending into the black area as it advances into the white area. These colour fringes were attributed to differences in the retinal action times of the photo-receptors bringing about the sensations of blueness and redness, for the time taken for the sensation of blueness to arise after onset of illumination is known to be less than that for redness.

BLUE FRINGE

"As the white area of the top advances into the black area, light strikes the corresponding part of the retina but as the sensation of blueness is aroused more quickly than that of redness, a blue fringe is seen at the leading edge of the white area. Similarly, a red fringe is seen where the black area advances into the white area.

"Benham's top is a modified form of Helmholtz's top in which the area of the edge is increased by means of the arcs and, as we should expect, the blueness extends over the white area between the arcs, whereas the redness is seen in the arcs themselves. These colour effects can be obtained in monochromatic light provided that the photoreceptors which normally evoke the sensations of blueness and redness have sensitivities extending over the wavelength being used

"In 1951 I suggested to the B.B.C. that they might produce colour effects in normal television transmitters by utilising this principle, and for this purpose a black and white film was constructed which, on projection, gave the impression of objects of different colours against a coloured background.

SAME PRINCIPLE

"A simple technique was developed which utilised the principle of Benham's top but which enabled the colours to be superimposed on drawings. Benham's top may be divided into eight segments (Fig. 3). Areas shaded in accordance with these eight segments are projected successively on to a screen, but the segment containing the arcs is replaced by a system of dots, thus increasing the length of the black-white boundary areas, on which the effect is to some extent dependent

"The desired colour effect for a particular area is obtained by shading the area on successive frames to conform with the code shown in Fig. 4 (a). Projection at the rate of 24 frames per second then gives three complete cycles per second and is accompanied with a coarse flicker. In order to decrease the flicker effect the coding may be modified as in Fig. 4 (b). A particular area may also be split up into sub-areas, giving further decrease in flicker.

"The sequence of eight frames to a cycle may be modified and 6-, 4-, or 3-frame cycles used. With 24 frames per second as used in film projection, a cycle of eight frames has been found to be too long, and one of four frames is more effective, although in this case colour effects are not so pronounced (see Fig. 5).

"By using these techniques it is possible to construct cinematograph films which, on projection, will appear coloured. Sets of cards are prepared with the different areas shaded in accordance with the code for the desired colour effects and these are photographed in sequence on successive frames of the film. A similar technique could be used on photographs of natural objects.

"In this case the dot pattern would be replaced by the actual area of the photograph (which would have to have some lines or shading added if these were not already present).

"In television, where a single scanning spot is used on a c.r. tube, a particular area of the screen is illuminated for only a small fraction of the total presentation time for each frame. The cumulative action of the eye largely compensates for this, however, and it is possible that more effective means of obtaining colour effects could be devised by utilising the fact that the image is traced out by a small moving illuminated area.

"Special techniques could be developed which would utilise the full 50 c/s scanning rate of the interlacing odd and even lines, rather than 25 c/s scanning rate which would result from using film.

"It was reported by the viewers on ITV that a person was seen wearing a blue tie with white spots. Although we should rather expect that a blue tie with black spots should be seen, there is no reason to doubt that the colours were subjective and were produced by characteristics of the film approximating to those described above."

So ends the quote and the article.

Without having studied the procedure and limitations in any detail, I am left with the impression that the whole phenomenon is a highly artificial one—interesting but with no prospect of adaptation as a means of entertainment.

Being a subjective effect, the degree and type of colour sensation registered by individuals would vary greatly. This much was evident from the reports published at the time in the daily Press.

I can just imagine members of the household having heated discussion as to whether the man's tie was blue with white spots or blue with black spots or just plain grey, like the one Dad wore to the wedding.

However, curiosity or not, a ready audience would be waiting for any station or sponsor who might get the film from I.T.V. and screen it locally.

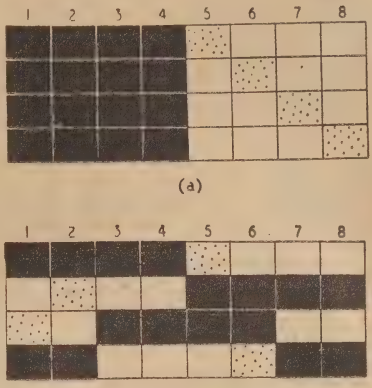


Figure 4: (a) Adaption of the eight segments of the top in figure 3 to a cycle of eight successive film frames. A different sequential pattern is used for each colour and dots replace the arcs of figure 3. In (b) are modified code patterns used for reducing flicker.

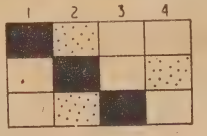


Figure 5: Simplified 4-frame coding system for use at a film projection rate of 24 frames per second.

ABOUT RADIATION

On an earlier page, we reprinted, in full, the letter from a correspondent who appears to know a good deal more about radiations than most of us. Being purely a layman on such a subject, I haven't the slightest inclination to "Buy An Argument" with him.

Actually, there seem to be few grounds for such argument because in at least two previous articles, one by Calvin Walters and one on Geiger Counters by Raymond Howe, we made the very point that our correspondent makes. But our "Tom" writer was unlucky enough to be misled by an ambiguous statement in a textbook.

Perhaps our willingness to publish the letter will be further indication to last month's correspondent that we don't ignore criticism altogether!

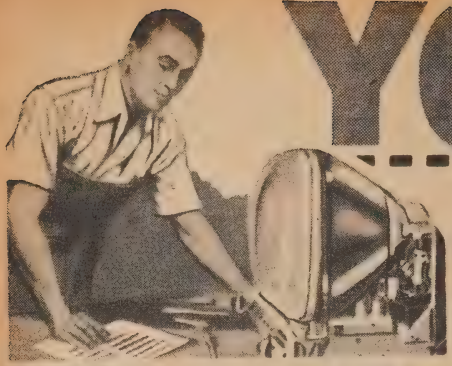
Come to think of it, of course, he also had a quarel with something we said in "Answer Tom" but on that occasion we were on "home ground." To date, no one has further challenged our remarks about classes of valve operation which clearly indicate that either:

(1) They agree with us, or

(2) They disagree but are disinclined to say so, or

(3) They are not sufficiently concerned to acquire and/or express an opinion.

(Continued on Page 112)



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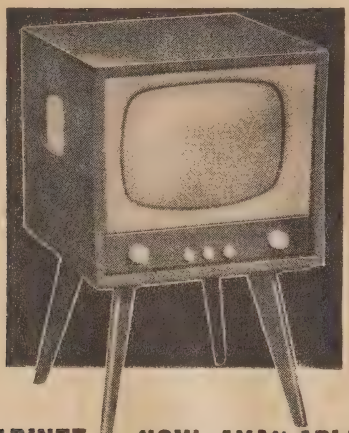

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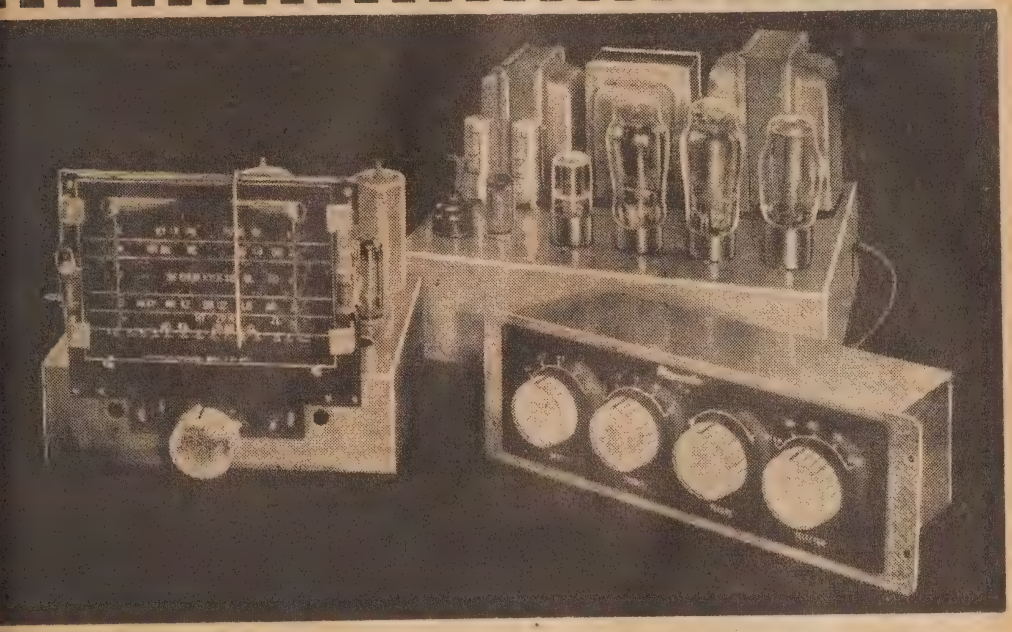

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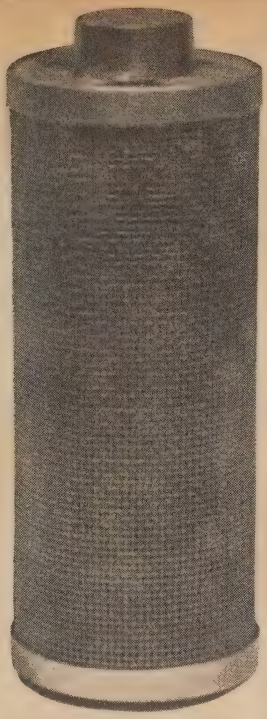

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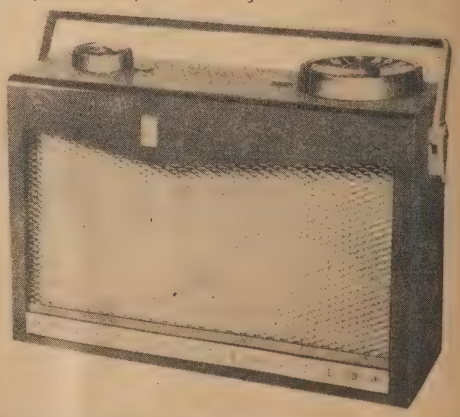

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FROM THE SERVICEMAN WHO TELLS

If I had to nominate the most difficult fault anyone can set before a serviceman it would be what I call—for want of a better name—the "fault which doesn't exist". Not only is it a source of annoyance to the conscientious serviceman, but also a source of unnecessary expense to set owners.

OU all know the type of thing I mean; a set which the owner claims is this or that wrong with it — in rms of performance, that is — but hich, when you put it on the bench, enerally performs perfectly and flatly fuses to do all the terrible things described.

If you're the type of serviceman who as taken the trouble to listen to and eed the owner's complaint, you are en faced with the problem of reconcilg the latter with your own observations. roadly, there are three possibilities: The et may have an intermittent fault, the rouble may be one peculiar to the locaon, or the owner may not be able to se the set properly.

If the fault seems likely to be an ntermittent one, then there is nothing or it but patient observation, systematic hecking — and a fair share of luck.

ON THE SPOT

In either of the other two cases the nly really satisfactory approach is to heck the set in its normal location and ope the fault will show up while you re there. This can be a time-consuming usiness but, at least, the customer stands chance of getting a satisfactory job.

The more usual approach, I fear, is to reat all incoming sets on a mass production basis, completely ignoring any comments the owner may make (if, in fact, he is allowed to make any at all), and imply give each set a routine overhaul, nvolving valves, voltages, and alignment. This done, the set is pronounced "100 per cent," returned to the owner, and the fee collected. It is left to the owner to discover that the fault is just as much in evidence as before.

It is not surprising, therefore, the number of times one hears the phrase, "I've already taken this set to two servicemen. They charged me so much, but the set still plays up."

A scathing condemnation of the service profession, if ever there was one.

NOT ROGUES

The ironic part about these situations is that the servicemen concerned are not fundamentally dishonest; they have no intention of deliberately "fleecing" their customers and, if one were to ask them, they would answer quite truthfully that they believed they gave honest service in exchange for the fees they charge.

Where they fail is in not realising that the customer's complaint is the most important piece of information they can have about any faulty set. Why does the customer want his set checked? In what respect does it fail to give him the performance he considers he has a right to expect? These questions, followed by more detailed ones, are those which should be asked about every set before ever a multimeter is brought near it.

I need hardly add that these remarks apply even more forcibly in the case of TV, where reception is so dependent on local conditions. In fact, it may well be that the advent of TV will help to re-educate those among us who have forgotten that servicing in general must extend beyond the four walls of the workshop.

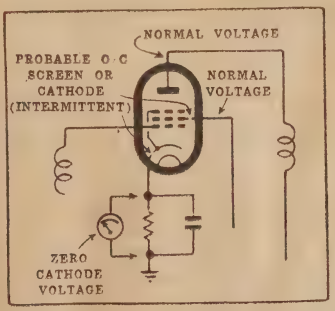
CAUSE OF IT ALL

As you've probably guessed, all this has been brought on by a flock of "non-existent" faults which have come my way in the past few weeks, and at least one of which was accompanied by the "I've - already - had - this - to - two - servicemen - etc." routine.

The first was a straight-out intermittent. It was a five-valve mantel set of a well-known make and, although old enough to use octal valves, was still young enough to justify keeping in order.

The owner explained that the set went well most of the time, and he was extremely happy with its performance while ever it kept working. His complaint was that the set frequently failed to perform after the normal warm-up period when, switching on.

He had discovered that the set would almost always come good eventually if one had the patience to wait long enough. Further, it came on quite positively, with a distinct click, and would generally perform perfectly thereafter until the next time it was switched on.



A faulty 6U7, having either an open cathode or screen, was the cause of intermittent failure in this set. It wasn't hard to find once the fault showed itself.

Another discovery had been made by his wife. Impatient to hear one of her favourite sob serials, she had administered a hearty smack to the top of the cabinet, whereupon the set "came good."

The owner then confessed, rather shamefacedly, that he had adopted this technique ever since, and that it usually worked. Now, however, he was beginning to wonder just how much longer the rest of the set would stand up to such treatment, so had brought it to me.

I had already half diagnosed the stage involved and when, in answer to my question, he admitted that the set still sounded lively, even when inoperative, I felt sure I was on the track. I would have been prepared to wager a dud 80 to my new oscilloscope, that it was an intermittent local oscillator in the converter stage. As it turned out, it is perhaps fortunate that there were no takers.

Checked on the bench the set put up a very creditable performance and—quite naturally—showed no evidence of the fault described. All I could do was set it up in a corner of the bench and arrange to switch it off and on as frequently as possible. The one bright spot was that the fault was evidently quite a positive one so that, once it did show up, there should not be too much difficulty in tracing it. All I had to do was be patient.

PERIOD OF DOUBT

At the end of three days, with still no signs of trouble, I was only thankful that I had taken the trouble to get the owner's story in detail. Otherwise I could easily have kidded myself that the fault really was "non-existent" and been tempted to return it after a routine check.

As it was, persistence won out in the end. The next day the set failed to come on after the usual 30 seconds or so, when I first switched it on in the morning, and I pounced on it eagerly.

Remembering my tentative diagnosis, I made straight for the local oscillator circuit. I was rather surprised to find that all the voltages appeared to be normal, including a quite definite negative voltage on the grid and every indication that the oscillator was, in fact, oscillating quite normally.

While this was a minor blow to my pride, there was no time to dwell on the point. The important thing was to check the remainder of the set before the trouble could correct itself, something which, by all accounts, was likely to happen any time in the next five minutes.

Next check point was the IF stage. Plate and screen voltages were approximately normal, but I was gratified to discover that there was no voltage being developed across the cathode bias resistor. In other words, there was apparently no cathode current flowing in this valve (a 6U7).

A sharp tap on the valve shield with the butt end of a screwdriver restored the cathode current — and the signal.

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er this the set behaved quiet normal- except for a few protesting crackles n the 6U7 when I tapped it again.

There seemed little doubt that the e was faulty, a diagnosis which was ickly confirmed by plugging in a new . As to the exact nature of the fault, n only suggest either an open cathode open screen connection, these being only two elements which will nor- lly cause complete failure of the node current.

Apparently the break was extremely ty, thus accounting for the temporary oration of the circuit when the valve med up, or when "bashed" in mod- tion. As for my faulty diagnosis, I st confess that I allowed myself to be nvinced on that one without sufficient l evidence.

t was true that the set showed some ns of life when it failed, due mainly to fact that it was a five-valve set with air amount of gain anyway, but had I n able to attack the fault in more surely fashion it would soon have n evident that the "liveliness" was t originating in the aerial circuit.

UMBER TWO

My second "non-existent" fault pre- sted a rather more personal problem, ismuch as the set involved belonged t a distant relative. I had already over- uled the set on a previous occasion. lt the owner complained that it was still ging trouble.

To be quite honest, what had happened that occasion is typical of the situ- on I described at the beginning of this icle, only this time it happened to me. The set had been delivered to me, not the owner, but by a mutual friend, th the request that, "Would you please eck it over and do what was neces- y." In reply to my usual inquiry as the nature of the complaint the mutual lend was rather vague.

"Oh, he said something about it being ak and he can't always get the stations operly. And I think he said it had a mming noise in it, too. Anyway, he emed to think you'd know what to do th it."

As it turned out, the set WAS weak ue to a sick valve and the need for ignment), and it DID have a hum in (due to a couple of aged electrolytics), d having cured these fault, I assumed e set was then O.K.

Thus I fell into my own trap, the only ce-saver being that the owner was only relative and not a "fair dinkum" cus- mer. (Like one of Dagwood's offspring, ho has expressed the doubt that fathers e real people, I never look upon rela- ves as real customers. They are more se, well, just relatives.)

WNER'S STORY

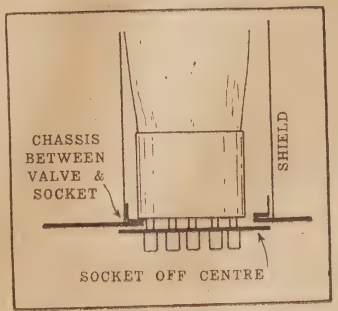
Thus it was that this particular set ounced." This time the owner deliver- d it himself and I was able to extract the ll story. It seemed that the main com laint was an intermittent complete fail- re, but which could be cured by touch- g "that" valve. "That" valve was the amplifier, another 6U7, as it happened.

On the bench the set behaved quite ormally at first, until I started fiddling ith the 6U7. Then I discovered that oving the valve back and forth in the cket, and while still inside the shield, evealed a position where the set failed ompletely.

I pulled the valve out and checked it n the tester. It checked O.K., for what at was worth in the present circum- tances, and I pushed it back into the socket. It was then that I fancied all was not as it should be, the valve seem- ing not to "seat" quite as it should, though had I not already been suspicious of the particular stage I would probably not have noticed it.

Closer examination revealed a very interesting condition. Apparently the socket had been mounted slightly off- centre relative to the chassis hole, so that the thickness of the chassis material in- truded between the bottom of the valve base and the top of the socket. In addi- tion, there was a layer of somewhat dis- torted thinner metal, being the valve shield base, in the same position. In all, I suppose, it amounted to about 1-8in.

This may not sound very much, but it was enough to prevent the valve from



A slightly off-centre valve socket caused this intermittent by preventing the valve from seating properly. Sometimes it would connect with all the socket contacts and at other times miss out. It was easily fixed once discovered.

being gripped effectively by the socket. A little vibration, as from a car journey, and it could easily "spring" upward ap- preciably. Then it was purely a matter of chance whether the valve made effec- tive contact on all pins or not.

MAKER'S FAULT?

Even more interesting was the fact that there was every indication that the socket had always been thus misplaced and that the valve had, therefore, never been properly fitted from the time it left the factory. The wonder is that it had performed without trouble for so long.

The cure was simple. I slackened off the mounting bolts, moved the socket a fraction to centre it, and tightened every- thing up again. This time the valve click- ed home positively, and I had no doubts that I had found the trouble this time. A prolonged test on the bench and much wriggling of the valve in its socket seem- ed to confirm this, and I passed it back to the owner.

My fee? Well, you know how it is with relatives, and, after all, I did score some copy from the job.

My third "non-existent" fault was the most nebulous and difficult of the three. It was a four valve mantel set, reflex type, and of a well-known make. The owner had had one small modification made to it, namely, the fitting of a pair of pick-up terminals to enable him to use it in conjunction with a separate re- cord player. I learned that this had been done by one of several servicemen who had handled the set.

The complaint was that it distorted badly on occasions, both on broadcast stations and the record player. The owner was most emphatic on this latter point, a fact which I considered could be very useful, since it seemed to pin the trouble down to the audio section.

The owner was also very emphatic— and a trifle bitter—about the fact that he had already submitted the set to sev- eral servicemen, and had had various components replaced, including some valves, without the trouble being located.

I made suitably sympathetic comments and secretly wondered how much of the dissatisfaction was due to failure of the serviceman to ask for, and customer to offer, the vital information regarding the set's behaviour.

As far as the set itself was concerned, I could find very little wrong with it, at least as far as distortion was concern- ed. I did get the impression that it was not, as sensitive as it might have been, considering it was a reflex, even though it played all the local stations without effort and with something to spare.

Apart from checking the valves, and finding them all good, I did nothing to the set except to set the bare chassis up on a corner of the bench where it could run for long periods. The owner had expressed the wish not to see it again until it was fixed " . . . even if it takes six months."

STUBBORN

I had assured him that it shouldn't take that long, but, at the end of a week, with no sign of the trouble, I was be- ginning to wonder. I had tried the set under a variety of conditions; early in the morning when it was cold, on regu- lar on-off cycles, warmed with a radia- tor, while I had also probed at the wiring and tapped the valves—all to no avail.

Then, one morning immediately after switching on, I had a brief insight into the nature of the trouble. The volume dropped slightly, and the signals began to choke up quite noticeably. Unfor- tunately, the trouble lasted for no more than a minute, and I had no time to make any tests before it reverted to nor- mal. Frustrating though this was, it was at least a start. I felt confident that the next time it happened it would last long enough to be of more use.

But I was wrong. The same thing happened the next morning, and the next, and the morning after that. It was plain that this line of approach would

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1763	100	200 — 230 — 240	300-CT-300	5V-2A; 2 x 6.3V — 2A
1764	"	" " "	325-CT-325	" "
1765	"	" " "	385-CT-385	" "
1766	125	" " "	285-CT-285	" "
1767	"	" " "	300-CT-300	" "
1768	"	" " "	325-CT-325	" "
1769	"	" " "	350-CT-350	" "
1770	"	" " "	385-CT-385	" "
1771	150	" " "	285-CT-285	5V-3A; 6.3-2A; 6.3-CT-2A
1772	"	" " "	325-CT-325	" "
1773	"	" " "	350-CT-350	5V-3A; 6.3-3A; 6.3-CT-3A
1774	"	" " "	385-CT-385	5V-3A; 6.3-CT-3A; 2.5-5A

Type	D.C. mA	Prim. Volts.	Sec. Volts.	Filaments
1775	150	200 — 230 — 240	385-CT-385	5V-3A; 6.3-3A; 6.3-CT-3
1776	175	" " "	285-CT-285	" " "
1777	"	" " "	325-CT-325	" " "
1778	"	" " "	350-CT-350	" " "
1779	"	" " "	385-CT-385	" " "
1780	200	" " "	350-CT-350	" " "
1781	"	" " "	400-CT-400	" " "
1782	"	" " "	450-CT-450	" " "
1400	250	200 — 220 — 230 —240 v	565-500-425 a side	2 x 6.3V-3A; 5V-3A 2 x 2.5V-3A
1371	300	" " "	1000, 850, 750, 600, 500 a side	

ULTRA-LINEAR

TYPE 931-15: 20 watts.
Prim.: 4500 ohms P.P.
Sec.: 3.7 or 15 ohms.
Resp.: 10-60,000 cps.
Valves: EL37, KT66. 6L6 etc.
19% Screen Taps.

TYPE 931-8: 20 watts.
Prim.: as 931-15.
Sec.: 2 or 8 ohms.
Resp.: As 931-15
Valves: As 931-15.
19% Screen Taps.

TYPE 921-15: 20 watts.
Prim.: 6600 ohms P.P.
Sec.: 3.7 or 15 ohms.
Resp.: 10-60,000 cps.
Valves: 807, KT66, etc.
19% Screen Taps.

TYPE 921-8: 20 watts.
Prim.: As for 921-15.
Sec.: 2 or 8 ohms.
Resp.: As 921-15.
Valves: As for 921-15.
19% Screen Taps.

TYPE 916-15: 12 watts.
Prim.: 8500 ohms P.P.
Sec.: 3.7 or 15 ohms.
Resp.: 10-50,000 cps.
Valves: 6BW6, 6V6, KT61, etc.
19% Screen Taps.

TYPE 916-8: 12 watts.
Prim.: As 916-15.
Sec.: 2 or 8 ohms.
Resp.: As for 916-15.
Valves: As for 916-15.
19% Screen Taps.

TYPE 949: 12 watts.
Prim.: 8000 ohms P.P.
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Valves: 6V6, 6BW6, KT61, EL84, etc.
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Prim.: 10,000 ohms P.P.
Sec.: 2 or 8 ohms.
(for "Rola" 120X)

TYPE 871 — 12 watts.
Prime.: 10,000 ohms P.P.
Sec.: 2 or 8 ohms.

TYPE 872 — 12 watts.
Prim.: 10,000 ohms P.P.
Sec.: 3.7 or 15 ohms.

HIGH FIDELITY +— 1db 30-15,000 cps

OUTPUT TYPE

TYPE 763 — 15 watts.
Prim.: 5000, 3000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TYPE 920 — 15 watts.
Prim.: 5000, 3000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

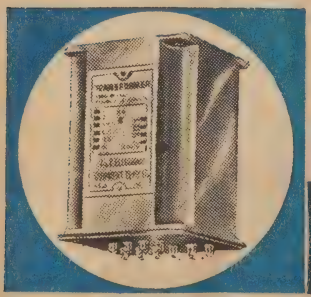
TYPE 897 — 15 watts.
Prim.: 10,000, 8000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 896 — 15 watts.
Prim.: 10,000, 8000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

MEDIUM FIDELITY +—2db 50-12,000 cps

Type	Watts	Primary	Secondary
809	15	500 ohms	15, 12, 8, 3.7, 2 ohms
914	15	5000, 3000 P.P.	500, 250, 166, 125 and 106
915	15	5000, 3000 P.P.	15, 12.5, 8, 3.7 and 2
917	15	10,000, 8000 P.P.	500, 250, 166, 125 and 100
918	15	10,000, 8000 P.P.	15, 12.5, 8, 3.7 and 2
922	25	8000 P.P.	500, 250, 166, 125 and 100

Type	Watts	Primary	Secondary
891	35	6600 P.P.	500, 250, 166, 125 100, 83 ohms
892	55	3200 P.P.	500, 250, 166, 125, 83, 62 and 50
928	5	7000, 5000 S.E.	12.5, 8, 3.7 and 2
929	10	4000, 2500 S.E.	15, 12.5, 8, 3.7 and 2
930	10	4000, 2500 S.E.	500, 250, 125
932	7	10,000 P.P.	15, 12.5, 8, 3.7 and 2



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t me nowhere. It was time to really me to grips with the thing.

Accordingly, the next morning I set some gear and connected it to the before switching on. I arranged the nal generator to feed a modulated sig- l into the aerial terminal, and the RO to check the waveform throughout e audio section, assuming I had time. I urted with it on the output plate.

Then I switched on. The set warmed , commenced to play normally, then ddenly distorted. The distortion was early evident on the CRO, and I dis- nnected it from the plate circuit with e idea of tracing through the audio ction. Whereupon the distortion van- ed as quickly as it had appeared.

More in desperation than anything else rocked the output valve in its socket id found that I was able to re-create e condition with the valve in certain itical spots, though even here the ef- ct was rather erratic.

Then I realised that the valve was not firmly held in its socket as it might ve been. I removed the valve, then ent over each socket contact with the iers and tightened it carefully. I was ot very hopeful that this would cure e trouble, but I felt it needed to be one, anyway.

GAIN UP

I was rather surprised, therefore, when switched on again and found that the verall gain of the set had increased ppreciably, and was now more like I magined it should be. There was no gn of the distortion, but I did not attach o much importance to this immedi- tely. On the other hand, it was ob- ious that there had been something rong with the socket and also that e trouble had been a function of the alve's position in the socket. I couldn't elp feeling a little hopeful.

Since time was not particularly im- ortant I let the set run every day for nother week and was gratified to note iat it showed no sign of the trouble. gave it a few more days after that, st for good measure, then returned it o the owner.

I checked with him again just before riting these notes and he reports all ell so far. I think I can safely trans- er that case history over to the "solved" ile.

THE CAUSE?

As for the exact cause of the trouble, 'm afraid I can only guess. It was ne of those cases where the trouble is ured before the symptoms are fully in- estigated, making an exact diagnosis mpossible. However, I am most in- lined to the theory that the grid pin was not making proper contact with the ocket, causing the grid to either open circuit completely or have much more esistance to cathode than normal. The latter condition, particularly, could cause he output valve to choke up due to grid blocking.

To round things off this month, I feel bound to comment on a newspaper clip- ping sent to me by Mr. B.C.W., of Cam- bewarra, N.S.W. It is from a handy hints column which appears regularly in one of our metropolitan dailies and the par picked out by the above gentle- man reads as follows:

"You can repair a radio valve in an emergency with lipstick. If the base of the valve is cracked, apply the lipstick and replace in the radio. The valve will last for a few days."

We are then advised that Mrs. L.P., of Auburn, N.S.W. was awarded a prize of 5/ for this contribution.

This is one of those typical feminine statements which is so hopelessly garbled and illogical that one hardly knows where to attack it first.

However, if you should happen to read this Mrs. L.P., perhaps I may start by pointing out the cracked valve base will seldom have any adverse effect on the valve's performance.

Secondly, if it did cause damage, it would almost certainly be in the form of a cracked glass envelope—and no amount of lipstick or any other substance will cure that fault.

Thirdly, it is difficult to explain why this method of repair (for whatever it is supposed to repair!) would only last a few days. One would suppose it would repair it permanently or not at all.

And finally, assuming that it is a purely mechanical repair that is required, such as a loose base and which need not necessarily effect the valve's performance. I can only comment that lipstick has no adhesive properties whatever. The only time lipstick holds things together is when it is sandwiched between the lips of a pair of young lovers in the moonlight. Even then, I am given to understand, it is not really the lipstick, but a far greater force which is really responsible.

So, girls, the moral is plain: Don't waste your lipstick on a cracked valve base when there is a serviceman handy.

MASTER BUILDERS OF EARLY HISTORY

(Continued from Page 17)

not exceeding one ten thousandth part of an inch. Most of this outer casing has been removed by robbers during the centuries to build their temples and houses, but sufficient remains to show the exquisite workmanship of the original.

Inside the pyramid are various rooms which also display remarkable skill in construction engineering. The King's Chamber, originally used for a tomb, is 34 feet long, 17 feet wide, and 19 feet high. This is made from tremendous, highly polished granite blocks, fitted together with consummate skill. The roof of this chamber consists of nine blocks each 19 feet long and four feet wide. These are surmounted by a further series of low chambers, which are finally surmounted by enormous sloping granite blocks at the apex, arranged with great skill to support the great load of the mass above.

The King's Chamber and other rooms have peaked roofs. Two of the stone roof blocks extend upwards and inwards at an angle of 45 degrees from the tops of the opposite side walls and meet in a peak above the centre of the chamber. This a well-known present-day architectural procedure.

The whole construction shows a remarkable degree of architectural and engineering skill and is only one of the many examples of ancient art as is manifested in such works as the Great Wall of China, The Hanging Gardens of Babylon, The Pharos of Alexandria, the Colosseum of Rome, the Ancient Cities of the Incas and many others, which I hope to touch on in future articles.

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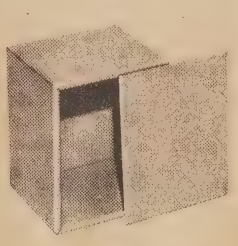

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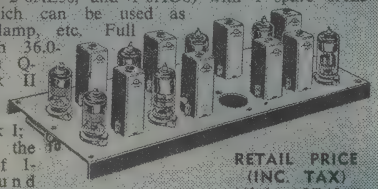

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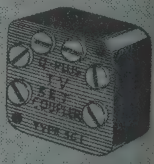

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Where signal strength is excessive causing picture overload, which can produce poor sync, distortion of picture, picture inversion (negative) or poor range of contrast, the insertion of a Q-Plus TV attenuator is required.
Q-Plus TV attenuators are made in attenuations of 6, 10 and 20db. Just connect directly to TV feeder and receiver. Complete with full instructions.

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Q-Plus VH02 Horizontal Sine Wave Coil
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An unshielded line width coil recommended for the adjustment of picture width by means of a variable inductor (width coil) across a small part of the horizontal output transformer, e.g. R.T. and H. 17in May, '57, features "clip-in" mounting, base lug terminations and Ferrite iron core.

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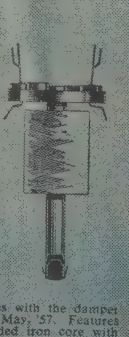

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Where two (or more) TV receivers are required to operate off the one antenna, a Q-Plus Set Coupler is required to correctly terminate the TV antenna and the TV receiver antenna input. Unless this is done, then serious mismatch could occur and could cause "ghosting" and other forms of loss of picture quality.
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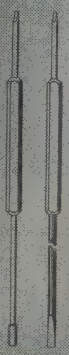

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An extremely versatile tool with hexagonal end and screwdriver end.
This tool is designed for the new "hexagonal" hole, and screw slot threaded iron cores.
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Q-PLUS AT2 ALIGNMENT TOOL

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Q-PLUS AT3 ALIGNMENT TOOL

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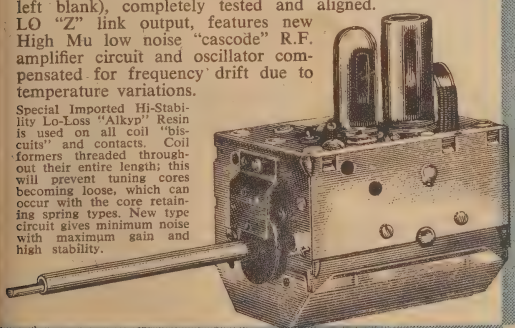

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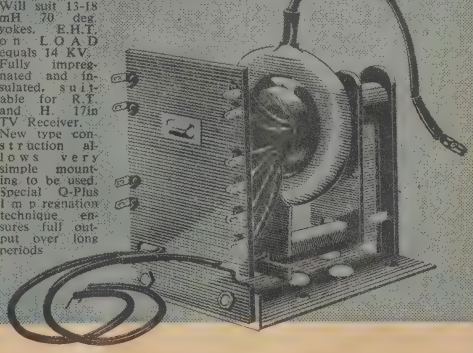
Will suit 13-18 mH 70 deg. yokes. E.H.T. on L.O.A.D. equals 14 KV. Fully impregnated and insulated, suitable for R.T. and H. 17in TV Receiver. New type construction allows very simple mounting to be used. Special Q-Plus Impregnation technique ensures full output over long periods



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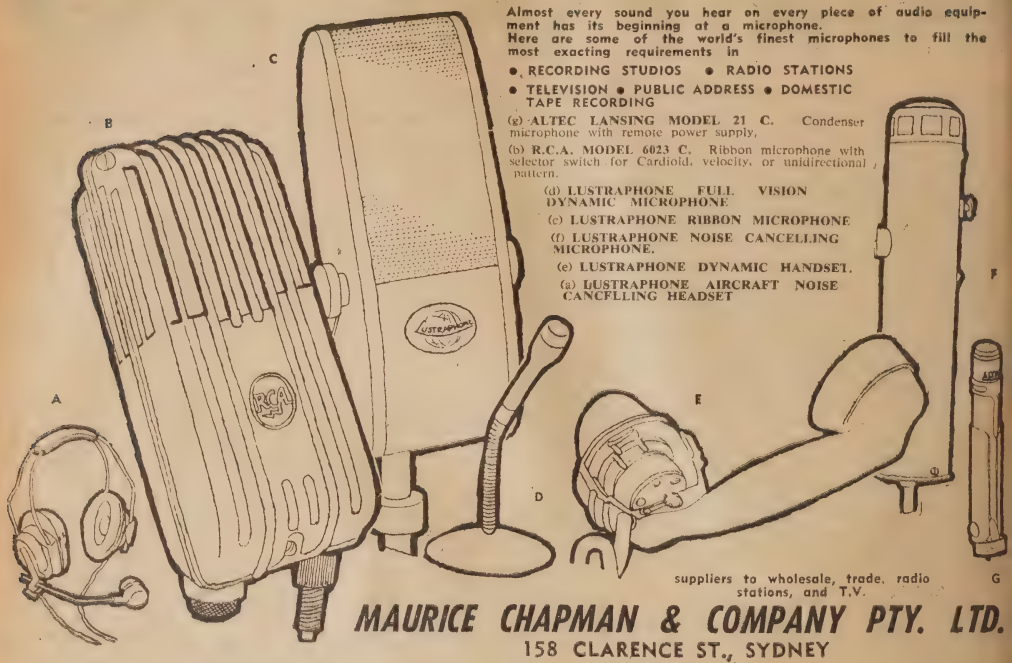

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OFF THE RECORD — NEWS & REVIEWS

Ever since hearing Arnold Sugden's demonstration of two-channel disc recording in England last year, I have kept a wary eye open for any signs that the larger record companies might be making a move in that direction. You will remember that, at this year's Audio Fair in London, Sugden demonstrated some processed discs using an improved technique.

by John Moyle

IT is well known that all the major record companies have experimented with the idea in the past, and with some success, but none of them has deemed the time ripe to take a plunge and put records on the market.

The system referred to is the recording of twin channels in a single record groove, using both lateral and hill-and-dale methods.

This calls for a special cutting head capable of producing a groove modulated in two directions, with low distortion and adequate separation of channels.

SPECIAL PICKUP

The record is played back with a special pick-up head also capable of responding separately to the two channels. The output from each section of the head is then carried away to dual amplifiers and speaker systems to give a stereoscopic or stereophonic effect.

There are other ways of combining two channels on a single disc. Emory Cook uses two bands on each side of his so-called binaural discs and these are played back with two standard pick-up heads attached to a single arm. The main disadvantage of this method, probably a fatal one, is that the playing time of each disc is cut by half thereby, and the long-playing feature of the modern record has long emerged as the most useful thing about it.

There are some electronic systems of modulating signals into a single groove, but the essentially mechanical method looks to be the simplest to use and to hold the most promise.

It appealed to me at the time as being the answer in the disc field to binaural tapes which, despite a reasonable amount of publicity and promotion, have not made very much headway except in the specialist market. They do not appear likely to make much impact at least in the immediate future.

A NEW FIELD

But, in looking about for a new field to exploit for record sales, sooner or later the twin-channel disc seems certain to be put to test. If it succeeds, there is big business to be had.

My latest information comes from America where the Westrex Corporation has announced a StereoDisk system of twin channel recording using a single groove.

This is not quite the same as the direct lateral-vertical system, in that the stylus cutting the groove is inclined at an angle of 45 degrees, which Westrex designate as the 45/45 system. It is claimed that this system has several advantages over its contemporary, such as wider frequency range and lower rumble. In a system sensitive to vertical as well as lateral movement, motor rumble can obviously be a problem.

The record company which appears to have done most work with the lateral-vertical system is English Decca, which sells in America under the London label. also used here for some discs.

This firm is generally recognised by the industry as having a workable system ready to release at any time, a fact which might well make others hesitate in the interests of uniformity. It would be fatal to have several methods all selling against each other.

The record industry does not want to enter into any more fights about standards!

The interesting thing about the Westrex move is their demonstration in Hollywood of records made with a new cutting head which they have developed. The head is not yet ready for release, but it has obviously been demonstrated with a view to providing material upon which the R.I.A.A. (Record Industry Association of America) can consider a standard for use by the entire industry.

As samples of Decca's work have almost certainly been made available to the R.I.A.A., it looks as though it won't be very long before we will see action on the stereoscopic front.

The significance of Westrex's action is that this firm makes large numbers of recording heads used by the record industry. With a satisfactory version of this head easily available, a big step will have been taken toward the production of records.

And this would be a wonderful thing for the industry.

As a final touch, it is almost certain that the records will be compatible — capable of being played either with special or standard pick-ups.

That could mean a change-over to a new groove shape for all records.

If ever this happens, the company which held strategic patents on equipment, for instance, would collect a fortune.

RICCI AND KATCHEN COMBINE IN GOOD BRAHMS

BRAHMS — Sonata No. 2 in A major for Violin and Piano Opus 100 Sonata No. 3in D minor for Violin and Piano, Opus 108. Played by Ruggero Ricci and Julius Katchen. Decca LXT 5270.

Brahms wrote only three sonatas for violin and piano, all of them rewarding musically, and displaying a skill in instrumental integration which even Beethoven himself did not share.

Their success lies largely in the way in which Brahms uses each to complement the other. There are many incompatibilities between the two instruments, whose use together is as much a matter of convenience as of choice.

Brahms had sufficient knowledge of each to produce a rare unity.

The second sonata is a bright work, filled with sunshine and happy movement, a mood which never really leaves it.

The third has more power and drama, although Ricci does not exploit it in this vein as strongly as Stern does in a fine Philips recording released some time ago.

But that is Stern's way—he is one of the most powerful violinists of the day.

Ricci, although not lacking in fire, sees the music more romantically, and rather more gently.

On both sides I thought he and Katchen made a good team. The latter has been held back from the microphone, without which he could easily have outweighed his partner, and sometimes he almost does.

Often you will hear him holding back the piano as though aware of the danger.

On the whole I was quite happy with the balance.

Ricci again betrays a tendency to shrillness in the upper registers although mostly he plays beautifully. And for that matter so does Katchen.

The surface and engineering are good.

DONIZETTI—L'Elisir D'Amore, with Hilde Gueden (soprano), Giuseppe di Stefano (tenor), Fernando Corena (bass buffo), and Renato Capecchi (baritone), with the Chorus and Orchestra of the Maggio Musicale Florentino conducted by Francesco Molinari Pradelli. Decca LXT 5155-7.

Donizetti's operas may not be remarkable for their plots or libretti, but they are not lacking in the stuff of which romantic operas are made — plenty of choruses, melody and tuneful arias.

Despite the romantic trials which torment the principals, there are few operas which are easier or more pleasant to listen to.

On this basis, I have little but praise.

There is not a great demand on the singers apart from their ability to sing, and Decca could scarcely have selected a better pair than Hilde Gueden and di Stefano as the stars.

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The soprano has a light and very sweet voice which she uses with great facility and charm.

The tenor is perhaps the best of the Italians recording at the present day, although his intonation was rather unsteady astray in the famous "Furtive Tear" aria.

The choruses are equal to most occasions and have plenty to do. The orchestra is not particularly prominent, but shines in the accompaniments, which is its main role.

VIEXTEMPS — Violin Concerto No. 5 in A minor played by Yehudi Menuhin and the Philharmonia Orchestra conducted by Anatole Fistoulari.

SAINT-SAENS — Violin Concerto in B minor. Played by Yehudi Menuhin and the London Symphony Orchestra conducted by Gaston Poulet. H.M.V. A.L.P. 1241.

Menuhin seems to be much more fortunate in his later recordings than he has been for a long time. So often he has disappointed me with unsteady intonation and thin, unimpressive tone that it is a pleasure to hear so much body and breadth as we do here.

Most of it is due to close miking of the violin to the great advantage of the lower strings.

And it is not surprising that the bite of the bow is so evident. I imagine there has been some work on the mixing panel, for the position in space occupied by the violin varies considerably and, because of the change in reverberation, it seems likely that Menuhin has varied his distance from time to time.

He plays, too, with vitality and feeling.

Both works are largely tuneful displays in which luscious tones contrast with passages of great difficulty and calling for high speed.

Menuhin is equal to them all. If you have been wondering what happened to the violinist we knew in earlier years this record will help you to find him. Even if there are a number of his contemporaries much closer to technical perfection.

Both recordings have a warm, full tone. The Philharmonia sounds the better orchestra, and its recording is fractionally superior.

It is a safely recommended record to anyone with an ear for the melodious and brilliant concertos that came from this musical era.

The surface is good.

TCHAIKOWSY — Swan Lake Ballet Suite played by the Philharmonia Orchestra conducted by Robert Irving. H.M.V. O.C.L.P. 1018.

Far too long to be played often in full, the music of this ballet, or portions of it, are known to practically everyone with the slightest musical interest.

For the full performance, there is Mercury's wonderful-sounding discs in an equally fine presentation album, but this single record contains a conventional suite comprised of 18 of the 39 dances.

A side-by-side comparison shows that the recording is not as brilliant as Mercury's, nor is the music as brilliantly played.

I don't mean by this that it has no vitality — it certainly has.

But there is little doubt that Dorati set out deliberately to create a smasher, and undoubtedly he did.

This, then, is high quality sound in the E.M.I. manner, and from E.M.I.'s famous recording combination. There is great body and dynamic range to it.

It has this quality — whereas Mercury's discs leave you a little breathless in an astonished kind of way, this one has more relaxation and warmth to it.

I doubt whether there is a better version available.

It would make an ideal Xmas present for both pedant and peasant, for the music belongs to all.

CIMAROSA—Concerto for Oboe and strings; VAUGHAN WILLIAMS — Concerto for Oboe and Strings; LUIS MILAN, Pavana and Gigue for Cor Anglais and Strings. Played by Mitchell Miller and the Saidenberg Little Symphony conducted by Daniel Saidenberg. Mercury MG10003.

An unusual record, unusual because oboe concertos are rare and because the music ranges a wide field.

The Vaughan Williams is one of those rhapsodical utterances of great beauty and fluidity which hark back to the period of the "Lark Ascending," although it was written about 10 years ago. If there is less freshness there is greater maturity, and its origin is obvious from the first chord.

The Cimarosa concerto, which is an arrangement by Benjamin of a keyboard sonata, is from a vastly different period, and although scored for modern instruments has been aimed at the style of the original. It is extremely well played and completely enjoyable.

STAR PIECE

This is apparently a star piece of Mitchell Miller's. The only other recording I have is on a Columbia disc and, although the soloist is not named on the label, I would be most surprised if it is not Mr. Miller himself.

Apart from similarities in style, the tone of the oboe, which is unusually full and bland, is too similar in both cases to be coincidental.

It is, in fact, a very good concert oboe, for many instruments are far too light and shrill to be so used with success. Some of its upper register sounds almost like a flute.

In the Vaughan Williams the orchestra is quite light and the recording hasn't a great deal of life. But it is clearly voiced and played earnestly if not with brilliance.

The Cimarosa has more roundness and the bass is stronger. Its colours are rather pale, but even in this it has a windswept quality and remoteness which are pleasant to hear if not sonically outstanding.

The little pieces for Cor Anglais are so different in their sound as to provide both contrast and surprise. They are much more forward and the tapes have some background.

If you like Vaughan Williams you'll think the record good value for this item alone.

BEETHOVEN—Sonata No. 14 in C sharp minor Opus 27, No. 2, DGG 30072 EPL; Sonata No. 26 in E flat major Opus 81a, DGG 30213 EPL. Played by Wilhelm Kempff.

Who would have thought a few years ago that we would have had available complete Beethoven sonatas on 7in discs!

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The psychological effect of their size might account for the impression that no time is wasted over them.

The first movement of the Moonlight is the best. The last hasn't as much vigour or drive as I feel it should, and some of the turns and technicalities are not expertly handled.

"Les Adieux" is more consistent although here again it seemed unsteady at times.

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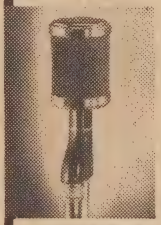

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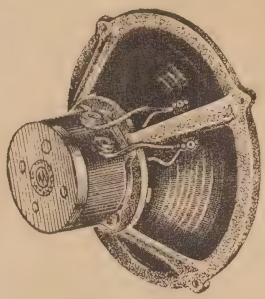

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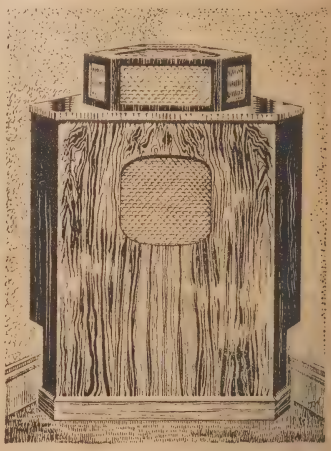

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RIMSKY KORSAKOV — The Tale of the Tsar Sultan Suite, Opus 57, May Night Overture; Russian Easter Festival Overture. Played by l'Orchestra de la Suisse Romande conducted by Ernest Ansermet. Decca LXT5311.

The Tsar Sultan music isn't nearly as well known as "Scheherezade." for instance, and to my ears it hasn't the same appeal as music for listening, although there is the typical splendour of musical colour.

It is possibly more directly descriptive and not so well suited as material for a suite.

But it is still very gorgeous and melodious and both Decca and Ansermet have as usual done a fine job of the recording.

The Easter Festival Overture is generally dismissed by critics as a kind of indiscretion which should be excused, and in truth it is rather noisy and obvious in both planning and execution

But audiences continue to like it and critics must therefore tolerate it, if with some regret.

Ansermet gets the greatest verve into it and you won't be disappointed in the result.

May Night is an early composition, easy enough to hear but not in serious competition with the composer's later work.

The most appropriate comment I can make is that it is true to label in every respect and the recording is extremely good.

ALBINEZ — Iberia (complete), arrangements by E. F. Arbos and Carlos Surinach. Played by the Philadelphia Orchestra conducted by Eugene Ormandy. In Album Coronet KLC 579-80.

I must admit to a very definite weakness for music of this type, and while I can easily imagine many people would wilt under nearly two hours of solid listening, I would remind them that I had no trouble with it, and that, being a collection of descriptive pieces or interludes, no pleasure is lost if they are heard when the mood and opportunity occur.

Albinez, as pointed out on the inner cover notes of the colourful and sensibly spiral-bound album, was the prolific founder of modern Spanish music. His work is Spanish as no other composer's has been before or since.

These twelve pieces were originally written for the piano. Albinez made some half-hearted moves towards orchestration, but this was left initially to Fenandez Arbos. He worked over five of them which, since 1927, have been played frequently and with success.

More recently the Spanish composer-conductor Carlos Surinach has orchestrated the remaining seven, and this is therefore the first complete recording of Iberia (Spain).

You will no doubt recognise immediately the work of Arbos or at least the most popular items such as El Albacin and El Corpus en Sevilla, but I doubt whether, without the aid of previous hearing, you could nominate the work of either arranger.

Incidentally, the excellent essay on the cover was written by Surinach.

Most of the sections are music-pictures of Spanish towns, but these are primarily signposts to the free use of folk tunes and regional colour.

And, as Surinach points out, these are more than mere simple sketches. They have a power and beauty which is fascinating and even moving.

The orchestra's performance is technically superb. One continually pays mental tribute to its flexibility, response and tone quality.

To suggest that a certain atmosphere is missing might be to say that only a Spanish orchestra can adequately play Spanish music, and with such an intimate score this might well be true.

Not being an expert on this point, I can only say that I enjoyed every minute. I was pleased to note that the music was not used as a Philadelphia showpiece. Instead I found an obvious attempt to do justice to it.

And because of the well-judged acoustics and remarkable clarity which high-lighted the Philadelphia soloists, you will hear every note.

These are beautiful discs which I rate very highly.

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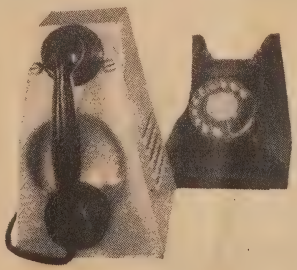

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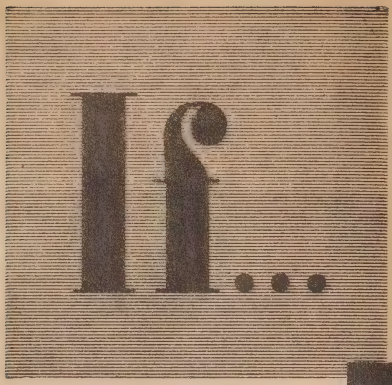

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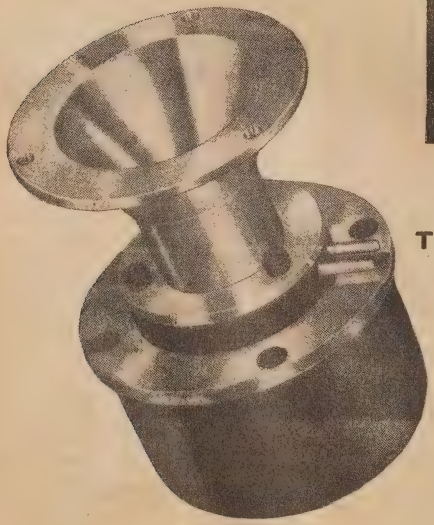

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BRAHMS—Violin Concerto In D Major Opus 77. Played by Zino Francescatti and the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet KLC 557.

In many ways this is a remarkable record, and I find it difficult to do justice to it.

I have never been able to see the Brahms Concerto in such a steely light as shines from it.

The steel is obvious from the first bar—it is that kind of sound. Even the orchestra has it.

The violin is extremely forward; it completely overshadows the orchestra almost throughout.

I found myself fiddling with the controls for the first time in a long while, but I couldn't quite subdue the sharpness of the string tone, nor do I really think it should have been necessary.

A record like this demands a big room to sound well, for to reduce the volume in order to get farther away doesn't work.

BRILLIANT FIDDLER

Of its brilliance there can be no doubt. Francescatti is a magnificent fiddler, and by the time you have heard him out, you can have no two minds about what he can do. The total effect is often tremendous.

But I had the feeling he was manhandling the music as it has rarely been taken to task.

It is probably the most beautiful of the violin concertos, and it must be given firm treatment.

It is the most spectacular of all the versions I have, as though the "best orchestra in the world" and one of its best violinists were striving to outdo each other.

Somehow I come back to the Martzy recording of the concerto when I really want to enjoy it, although this remarkable woman isn't in the same class as a technician. But she has a warm heart, and Francescatti has not.

You will certainly admire this kind of Brahms, but it is a demanding performance which you may find hard to love.

Despite its sharp edge, the playing is very fine and often lovely. The recording amplitude is extremely high, which may have something to do with its rather strident tone.

One more for the top drawer.

TCHAIKOWSKY — Nutcracker Suite Opus 71a; CHABRIER—Espana: PONCHIELLI—Dance Of The Hours; SUPPE—Morning, Noon And Night Overture. Played by the Royal Philharmonic Orchestra conducted by Sir Thomas Beecham. Coronet KLC 622.

This is the Nutcracker Suite you hear played most often, and, of course, it contains only a few of the many sections of which the entire ballet is composed.

But you don't often hear it played as well as this.

The appeal of the music as a ballet is largely forgotten now—it is performed so rarely that comparatively few people have even seen it as such.

And frankly, when played as beautifully as under Beecham's hand, I hardly think it matters.

This record has the authentic Beecham touch—carefully and tastefully modulated, stylish but always musical, brilliant but not overspectacular, lively and clean, all ragged edges polished until the music glows.

I doubt whether there is another recent version in which each section sounds so right.

The recording is worth special comment. Its quality is intimate and immediate, with a fine presence which does not project itself unduly through the room—a very good example of that fine balance which British orchestras seem to achieve nowadays.

INSTRUMENTAL HIGHLIGHTS

Each movement has an instrumental feature which must be adequately highlighted without being overworked. For instance, there is the celeste in the Sugar Plum Fairy, the flutes in the Dance Of The Flutes, and the harp and horns in the Waltz Of The Flowers.

The recording engineers have done their work well here, without in any way belittling the remainder of the orchestra.

The bass end, and the warm, full tone throughout, are a pleasure to hear.

The tempo of the last section, often played much more quickly, the integration of instruments without loss of definition, and the accurate and unanimous beat are all typically Beecham.

The three items on the reverse complete what must be as good value for the money as is offering these days.

It is true that Espana is a little more restrained than I like, the touch a bit heavy in the Dance Of The Hours, and there is groove echo in the mighty but overmeasured Suppe overture, but most will consider them well done.

There is some recorded background noise to be heard at times, the sound deteriorates to some degree on the heavier passages, and the surface has some faint clicks. But these are minor points, for the cutting amplitude is very high.

In brief, a really good disc.

TOP AWARD FOR NEW PICTURES RECORDING

MOUSSORGSKY — Pictures At An Exhibition. Played by the Philharmonia Orchestra conducted by Herbert von Karajan. Columbia 330CX 1421.

Any full-scale version of the Pictures must stand up to a comparison with Mercury's effort of some years ago, released here by H.M.V. on a 10-inch disc. Even today, it is a landmark in recording.

This new one is the only one I know which can be considered seriously as a rival.

Karajan's approach is more analytical than Kubelik's. He has thought rather more about the musical implications of the work. Kubelik was more concerned about the impact of the sound, although his ideas were in some places conveyed more effectively than Karajan's.

It would take too long to go through all the sections, but I liked Kubelik's brisk Promenade, and his portrayal of the fawning Jew (and Fercury's recording of it) may never be bettered.

However, as I haven't seen the pictures which are represented, I can only assume that both men are legitimately competent to colour their own impressions.

On the whole, Karajan's recording is better than Kubelik's. It has better balance and body, although it isn't so strikingly brilliant. It is recorded at a higher level, and shows evidence of more recent techniques.

But the difference isn't as much as one might expect, although I didn't think the H.M.V. version as good as the original.

And yet the American disc suffers from a background of rumble which would discount it today.

I must therefore register this new disc as the best currently available, with no technical problems and an almost dead quiet surface.

It has extraordinary dynamic range, plenty of first-class bass, and strong but not strident brass.

For me it is a five-star effort.

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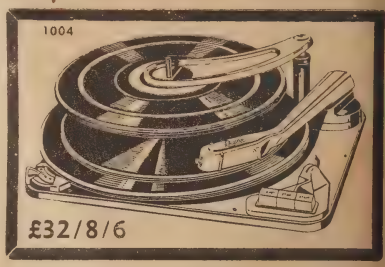

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BEETHOVEN—Quartet No. 13 In B Flat Major Opus 130; Quartet No. 17 In B Flat Major Opus 133. Played by the Hungarian String Quartet. Columbia 330CX 1405.

To say that this is one of Beethoven's best works, which should be known to every music lover, is merely to state the obvious. It is equally obvious that the performance by such a distinguished quartet must be considered very seriously.

My first reaction was much the same as I experienced when hearing the first records by the Hungarians—that they habitually play everything too quickly.

Subsequent playings did much to reconcile me to this outlook, but I still retain an unsatisfied feeling in many places that the music has passed me by before I have had a chance to really hear it.

This is particularly true of the second movement, which is far too delightful to run away from us at such a pace.

The amazing thing about this quartet is that, when you become used to its speed, you realise that, technically, very little if anything has been missed by the players.

Whether you believe they have really grasped and given out the full stature of the work or not will depend a good deal upon your temperament. As I see it there is an appropriate tempo for this and for most other of the later works which is part and parcel of their being. To rush them, psychologically or in fact, is to cheat the listener of the time factor essential to the serious business of musical absorption.

But if you can hurry your reactions sufficiently, you will, as I have indicated, regard this as a distinguished performance.

It is probable that all the Beethoven quartets were recorded under the same conditions, which provide a lively studio sound that the concert hall atmosphere is almost noticeable. I don't at all object to it, nor is there any feeling of remoteness associated with the sound.

In fact, the near-orchestral use Beethoven makes of the strings is, if anything, benefited thereby.

The Opus 133 was actually the final movement of this quartet, but Beethoven replaced it after an initial performance. It is far more complex in structure and material than the earlier movements, a fact which alone justifies its ultimate separation. It requires a completely different kind of listening.

This is an important release at a time when chamber music of this kind and standard is available far too rarely.

Doctor Watson Meets Sherlock Holmes and The Final Problem. Stories by Sir Arthur Conan Doyle dramatised by John Keir Cross. Sir John Gielgud (Sherlock Holmes), Sir Ralph Richardson (Doctor Watson), and Orson Welles (Professor Moriarty). Decca LKA 4164.

Unless you are a student of Sherlock Holmes, you will rate this record as first-rate.

It has an impressive array of stars, all of whom are skilled in their art, and who have obviously put a great deal of thought and effort into it.

But if you really know your Sherlock, you mightn't be so impressed.

Holmes is far too soft and easy-going to satisfy me. We are told that he was a man of rare smiles, but here he not only gives way to frequent laughter, but giggles almost like a schoolgirl. There is none of that asperity and impatience for which he was notorious.

Nor is there real tension in his first meeting with Moriarty, a tension which must have been there for all the light-hearted banter, none of which is improved by additions to the dialogue.

I could go on at length, for there is more to tell.

Watson is much too sophisticated for me. Despite his solidity and occasional shrewdness, he was something of an earnest bumbler, and Richardson is much too suave an actor to sound anything more than an experienced man playing down to a part.

Orson Welles as Moriarty is much more convincing, and I wouldn't quarrel with him.

It was a mistake to overplay the violin theme which Holmes allegedly composed, an annoying thing which drove me to distraction. I couldn't imagine Holmes being responsible for such a maudlin device.

The best part of it is the Final Problem. Here all the matters complained of are present in their least objectionable form, and the dramatic effect and content are most convincing.

My best advice is to hear it for yourself.

RICHARD STRAUSS—Don Juan Opus 20; Waltzes from Rosenkavalier; Till Eulenspiegel Opus 28; Love Scene from Feuersnot Opus 50. Played by the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet KLC 616.

A good record if you are looking for a cross-section of orchestral Strauss played by an orchestra which shows up best with brilliant, tuneful music. It is easy to see why Strauss in his time was considered by many to be the ultimate composer.

Technically, it has a full-bodied, rich tone, ideal for the purpose. Reverberation is decidedly more than average. The sound has a lively atmosphere rather overdone by ideal standards, but it certainly gives breadth and size to the orchestra which is most impressive. In its sheer weight it is almost overpowering.

I liked the vividness of the bass strings which won't call for any reinforcement on your part.

Don Juan emphasises the romantic atmosphere, and manages it rather better than in the passages of unrestraint, where the brass might have come through with a sharper edge.

The famous staccato horns, too, are not as distinct as they should be.

The Waltzes have weight and vigour without any cause for further comment.

The characterisation of Till is better handled on some other versions, but the superb playing and great dynamic range of the recording are undeniable.

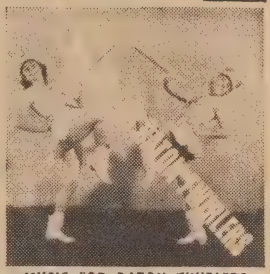
The performance is spectacular rather than subtle, and reverberation tends to cover up a good deal of individual work, particularly from the woodwind.

The love scene from Feuersnot isn't as familiar as the rest—it might even be a first recording—and continues in a strong, romantic and, at times, Wagnerian vein which gives ample scope for the Philadelphia strings.

There are some surface blemishes, but for the most part they are covered up by thrilling sound which, in heavier passages, has a trace of roughness.

In brief, a spectacular record, in which the orchestra comes off rather better than the music.

Music in the MERCURY manner!



MUSIC FOR BATON TWIRLERS
Carl Stevens and his Military Band
The Thunderer; The Official West Point March; Anchors Aweigh; Marines Hymn; Semper Paratus; The U.S. Air Force March; Colonel Bogey; Fairest of the Fair; Bombasto; El Capitan; The Invincible Eagle; Muskat Ramble.
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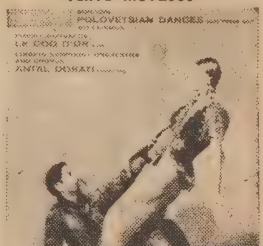
HERE COME THE GIRLS
Ella Fitzgerald: A Beautiful Friendship; It's Only A Man; Too Young For The Blues; The Silent Treatment. **Anita O'Day:** The Get Away And The Chase; Honeysuckle Rose; You're The Top. **Jane Powell:** Mind If I Make Love To You; True Love. **Toni Harper:** We've Got To Live, Got To Grow; Love Is A Wonderful Thing; I Telephoned, I Telegraphed. **Pearl Bailey:** Tired; Go Back Where You Stayed Last Night.
VERVE MGV2036



Borodin — POLOVETSIAN DANCES
Rimsky Korsakov — COQ D'OR SUITE
Lond. Symph. Orch. & Chor. cond. by Antal Dorati.
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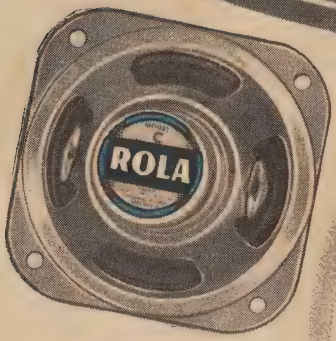
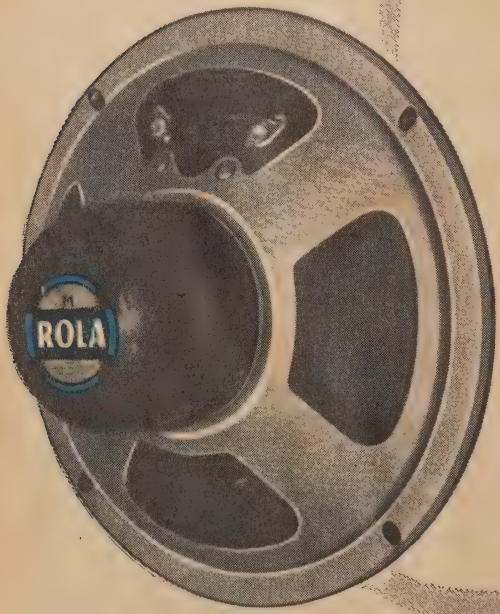
The TV Pair





These two new Rola loudspeakers, Models 6M and 3C, are particularly suited for use in table model TV sets where space is at a premium, yet adequate facilities must be provided for the extended range reproduction available from TV's frequency-modulated sound channel.

Both new speakers incorporate the famous Rola "Fluxmaster" principle which eliminates the stray magnetic fields which can distort the TV picture.

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ROLA COMPANY (AUST.) PTY. LTD.

THE BOULEVARD, RICHMOND, VIC. JB 3921. 116 CLARENCE STREET, SYDNEY, N.S.W. BX 3

BEETHOVEN—Violin Concerto in D Major Opus 61. Played by Nathan Milstein and the Pittsburg Symphony Orchestra, conducted by William Steinberg. Capitol P-009.

This is vigorous, fast-moving Beetho vi, more notable for its vitality than for depth.

It is the antithesis of the Schneiderhan rording by DGG which, for all its died handling. I prefer for its sicianship.

The Berlin orchestra, too, has greater ources than the Pittsburgh which, time er time, shies away from becoming involved in the score.

Milstein's part is rather in keeping h it. He is as steady as a rock, his ionation and dexterity are faultless, but rarely builds up an atmosphere of anv s.

He is closely recorded, and his higher ister is often shrill and thin; too light stand up fully to the music.

GH MERIT

At the same time, in a field of compent versions, none of which has ched outstanding proportions, this re- d must be included as being of merit mparable with most of its contem- paries.

t is not recently made, and the sound, nough far from inadequate, is not s king.

Some of the best playing is in the sond movement, where Milstein ieves that atmosphere of stillness whch the main magic of this exquisite music

This, and the lightweight last movent, are the most successful portions the performance.

But here, as elsewhere, I would have ed to hear more from the orchestra.

The surface is good. Cutting ampli- e is not high, nor is the dynamic nge, at least in comparison with efforts more recent date.

PUCCINI—Operatic Arias sung by Antonietta Stella with the London Symphony Orchestra conducted by Alberto Erede. HMV ALP 1428.

I received something of a shock when is disc began to play. For me, Stella s new singer, and a most exciting one I an guess that we will hear more from h later on.

Certainly she hasn't shirked a severe st—the record contains just about all t best known Puccini arias—and so ites comparison with the work of e ry modern operatic soprano.

And in her best efforts she can hold h own with any of them. Her high nge is strong and accurate. Some of h notes are really magnificent, with t full authority and ring demanded of t prima donna.

At times she reminds one of Tebaldi a others of Callas, but her voice has a fishness which is her own.

Dramatically she is not as smooth as Tebaldi, nor does she achieve that disembodied purity which Tebaldi can do better than anyone. She is not as forceful as Callas but she has plenty of power and her voice is more consistent.

She has not yet learned the art of ging the dramatic progress of an motional aria; she tends to anticipate t high spots and thus weaken them ven they come.

But she has the authentic soprano's equipment, and a sincerity which makes some of her performances most moving. If you haven't yet heard her you are in for a surprise

This is a lovely record to play. The recording is almost faultless and the orchestral accompaniments of particularly high quality. The voice has great presence, and although the cutting amplitude, is high it played cleanly for me. Surface noise is non-existent.

Musically I thought it quite a highlight—technically it is up to demonstration standard

HIGH FIDELITY CLASSICS — Demonstration Disc (Selections from Copland, "Billy The Kid;" Albeniz, "Sevilla;" Delius, "On Hearing The First Cuckoo;" Beethoven, "Pastoral Symphony" Excerpt; Villa-Lobos, "Quator;" Shostakovitch, "Quintet For Strings") Capitol LAI. 9024.

By a coincidence, after writing so much about listening to amplifiers and of records for the purpose and, after having reviewed a 12in Capitol about which you read last month along comes a second demonstration disc from the same studio to underline what I have been saying.

This is a 10in effort, and once again it contains excerpts from standard Capitol releases, cut with special care (according to the accompanying booklet), precise groove dimensions, and wider than usual groove spacing

Once again the stress is on listening, and there is little doubt that there is a great deal to be heard.

Says Charles Fowler who wrote the notes, "As you listen to the excerpts on this record, listen deeply to each instrument, to the balance of instruments, to their tonality, to the difference in these considerations from one track to another; to study, to understand the effect which the combination of composer, conductor, and producer have striven to create for you"

COMPLETE ITEMS

Except for the excerpt from Beethoven's "Pastoral," each item is complete in itself, and I think this is important even if, as in the case of the Shostakovitch, the movement played is a short one. Records like this which are meant to be heard with concentration should not offer a psychological shock when the piece breaks off in the middle—that's the best guarantee that the owner will always avoid that section when he plays it through

I thought all the selections were good judged on their total interest value. The Delius doesn't sound like English Delius, and the piano selection, as the notes point out, is intended to demonstrate interesting piano tone rather than "mellow" quality

But the sum total is on the credit side.

My only criticism—and we should be hard on discs like these—was a fraction too much rumble on one side, and a pre-echo on the first note of the piano which, with the special quality claimed, should not have been there.

And these points are too minor to count seriously against it.

NOTICE!

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SHORT-WAVE NOTES BY ART CUSHEN

FLASHES FROM EVERYWHERE

PERUVIAN station OAX6H, broadcasting from Tacna, has been heard from 9.30 p.m. on 9495 Kc, with a good signal in usual commercial programs in Spanish. The station is only heard to 10 p.m., when the Mexican signal XEWW on 9500 Kc opens the transmission for the day.

ICELAND transmitter TFJ, using 12175 Kc, which we have given publicity to last month, has extended its schedule and now operates daily 10.00-11.15 p.m. and 6.00-7.00 a.m.

FRENCH SUDAN is the location of a new station which operates with the slogan Radio Sudan, and this station is operating on 4835 Kc with a 4 Kw transmitter. Broadcasts are made in French and other vernacular languages, but the exact transmission schedule is not known.

RADIO TCHAD in French Equatorial Africa, which broadcasts from Fort Lamy, operates 9.00-10.45 p.m., 3.15-6.00 a.m. on 4904 3 Kw and 6200 Kc with 250 watts.

TAIWAN station BEC27, of the United States Armed Forces' Radio Service, operates with 1000w on 1560 and 7210 Kc. The broadcasts are in English and recently reverted to a schedule alteration, due to standard time again in operation in the country. The station now broadcasts 7.00 a.m.-2.05 a.m., with sign on on Sundays at 10.00 a.m. News is carried midnight and 2.00 a.m.

IRAN operates several low-powered regional transmitters which are heard in the early mornings and the present stations known to be in service are Radio Meshed 6250, Isfahan 6521, Shiraz 6383, Koydestan 8106, Ahwaz also on 8108 Kc.

AUSTRIA'S RADIO WEIN, in Vienna, is operating on the following schedule, reports the World Radio Handbook—OE123 7245 Kc 4 Kw, 10.00 a.m.-noon and on Sundays 11.00 a.m.-noon and daily 7.30-8.30 p.m.; OE130 5985 4 Kw, daily at 5.00-7.00 p.m. and 11.00 p.m.-3.00 a.m.; OE123 9665 4 Kw, daily 5.00-8.00 a.m.; OE138 25615 20 Kw, daily 5.00-7.00 p.m. to South America.

TANGIER station WTAN, over the Voice of Tangier on 9418 Kc, is heard with "Back to the Bible" broadcasts 6.30-7.00 p.m. and also in English from 5.30 a.m. and on Wednesday at 5.00 a.m. WTAN now is reached by reports to WTAN, P.O. Box 2219, Tangier, Morocco.

RADIO PEKING, in its new English schedule which is now in use, carries programs as follows:—5.00-5.30 a.m. to North Africa, Middle East, on 11945, 15370 Kc; 5.30-7.00 a.m. and 7.30-8.00 a.m. to Europe on 9460, 11650; 11.00-1.30 p.m. to North America, 15115 and 17745; 7.00-7.30 p.m. on 11820, 15350, to South-East Asia, while the transmission to Australia and New Zealand, 7.00-8.00 p.m., is broadcast on 15060, 17835. To India and Pakistan 1.00-1.30 a.m. on 15095, 17680; 1.30-2.30 a.m. dictation news on 15095 and 17680; Spanish to Europe is released on 6.30-7.00 and 7.30-8.00 a.m. on 9460, 11650 Kc.

SYRIA'S usual two-hour program from Damascus for West Europe has been shortened and can now be heard 5.30-6.30 a.m. on 15165 Kc, French at 5.30 a.m. and English 6.15 a.m.

DAKER in Senegal has been noted by Kevin Dunham, Narrandera, N.S.W., in the afternoon transmission from 4.00 to 6.00 p.m.

The musical program is generally well received and the signals are normally at good strength. The station on 11895 Kc is also heard in the morning with English news at 8.30 a.m., and after this 10-minute session the station signs off at 8.40 a.m., with the French National Anthem.

UNITED STATES transmissions have been noted by Kevin Dunham, who reports the Armed Forces' Radio Service in New York as being heard from 3.30-8.45 a.m. on WBOU (17780), WRUL (17750), WRUL (17710), WRUL (15350) and WBOU (15270), the latter station having moved from 15285 Kc. The United Nations transmissions on U.N. Radio is active again during the present session in New York, and the best received are KNBH (11710), from 5.45-6.00 p.m., with transmissions directed to Australia. The Tangier 11790 WBOU 15440 stations have been heard 3.00-8.00 a.m., with news from the meetings of the General Assembly and relays of the debates.

RADIO JAPAN plans to step up its overseas broadcasts to 24 hours a day during 1958 from the present 15 hours' broadcasting each day. New transmissions would be directed to Africa and Central America.

MAIL deliveries to North Korean and Northern Vietnam has been puzzling our readers, as such letters are being returned marked "no service." We would suggest that readers send their reports via Peking, as we have found this a more reliable method.

CANADIAN IKW STATION IS HEARD

One of the lowest powered shortwave transmitters VE9AI, in Edmonton, is providing fair signals in this part of the world.

THE reception of one of the oldest established, and lowest powered, Canadian shortwave stations can be taken with some pleasure, and this month the signals of 100 watt VE9AI have been heard.

The station, which relays broadcast band transmitter CHCA in Edmonton, Alberta, uses the slogan Radio 930. VE9AI operated on 9540 Kc and it was indeed a surprise to hear this station at 11.45 p.m. on a Saturday evening with a program of polka and Scottish dance numbers, local commercial announcements for sponsors in Edmonton and Calgary.

Identification followed at midnight, and the station dropped in strength to fade out soon after.

The signals were only fair in strength and there was severe interference from the many stations on this congested frequency.

VE9AI is the lowest-powered Canadian private shortwave station in regular operation, although we have heard announcements from the Vancouver station CKWX that they have again put the 50-watt station CKFX on 6080 Kc. This is a station which we verified several years ago.

VE9AI, which relays CJCA, is owned by the Edmonton Broadcasting Company, Buirks' Buildings, Edmonton, and commenced operation in 1922. The station is affiliated with the Trans-Canada network.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Eastern Australian.

Prague to South Pacific

A SPECIAL transmission to Australia and New Zealand has been commenced by Radio Prague, Czechoslovakia, from 6.30 to 7.30 p.m. daily. The signals are excellent on OLR7A on 21450 Kc, but the two other frequencies, 17810 and 15180 Kc, are both covered with severe jamming.

As all these frequencies are new to the station, reports are requested to Radio Prague, Prague 12, Czechoslovakia. The station has also made some changes in the transmission to North America, heard at 3 p.m., and this is now broadcast on 7250, 9510, 9550, 11830 and 11930 Kc

DX SESSION FROM RADIO AUSTRALIA

The popular session from Melbourne has now been revised to broadcast as follows.

Sundays 8.00 a.m. on 17790 Kc East Asia and North Pacific.

Sunday 3.30 p.m. on 21680 Kc to Africa.

6.45 p.m. on 11710 Kc to Europe and South Pacific.

Sundays 11.30 p.m. on 11810 Kc to U.S.A. East Coast.

Monday 2.00 a.m. on 11810 Kc to North America, and to Asia and Europe, on 11710, 9580, 7220 Kc.

FRENCH GUINEA station Radio Conokrey has been heard in New Zealand opening at 4.30 p.m. on 4910 Kc with some interference from VLM4 in Brisbane on 4920 Kc. The station fades out after 5.00 p.m.

HAITIAN station 4VEX has been heard on the new frequency of 5740 kilocycles, and was noted with a new slogan, Radio Haiti, The Voice of Haiti, and North American listeners are hearing the station from 11.00 a.m., and in this area the morning broadcasts, which are heard here at 9.00 p.m., should be possible to be received.

TEHERAN RADIO has been heard on 17776 Kc with a short five-minute news session in English at 6.00 a.m., and is also in chain with an outlet on 9680 Kc.

United Nations Command

THE Voice of the United Nations Command which operates transmitters in both Kore and Japan, is now operating on a new schedul and several of the frequencies have been receive in this area.

Broadcasts are made in Cantonese, Mandari and Korean, from 8.30 p.m. to midnight, and the the session is rebroadcast at other times to 10.0 a.m.

The programs are carried on VUNC-Korea, a Seoul on 760, 1220 Kc, 1 Kw, and 2720, 3765 both 300 watts are on the air, 8.30 p.m.-10.00 a.m The NHK Yamata shortwave transmitter JBD2 on 9560 Kc, 10 Kw, 9.00 p.m.-4.00 a.m.

JBD, using 6015 Kc with 20 Kw, carries th broadcast 11.30 p.m.-9.00 a.m. The second net work of the Korean Broadcasting System in Seou also takes part of the transmission and it i carried by these stations, 10.30 p.m.-midnight

Schedule from Lisbon

THE present transmissions of Emisora Nacional at Lisbon includes two transmissions in th 13-metre band and it is as follows:—8.00-11.15 p.m on 21495 Kc, directed to Timor and Macau 11.15 p.m.-3.15 a.m. on 21495 and 11.30 p.m. 3.00 a.m. on 17880 Kc to Goa India and Pakis tan; 3.15-4.00 a.m. on 17895 to East and Sout Africa; 8.00-11.15 p.m., 3.15-7.15 a.m. and o Sunday 8.00 p.m.-7.15 a.m. Monday on 2170 and 4.00-7.15 a.m. on 17895, also 6.00-7.15 a.m on 15125 to Portuguese East Africa, Angola an Sao Tome; 7.30-10.30 a.m. on 15125, 7.30 a.m. noon on 17895, and 7.45 a.m.-11.00 a.m. o 15100 Kc, to North Atlantis, Guinea, Cape Verd and Brazil. 11.00 a.m.-2.00 p.m. on 15100, 12.15 2.00 p.m. on 11840 Kc to North America (Eas Coast) and from noon-2.00 p.m. on 9635 Kc, t North America (West Coast).

Seoul on HLK6

The first English transmission heard from Seou at a time more suitable to reception in this area and at a strength which is of reliable qualit has been noted on the session from HLK6 o 11925 Kc, from 6 p.m.

The transmission is of one hour, the first 3 minutes in English and the remainder in Korean

Using the new 100 Kw transmitter, the fre quency in use is clear from interference and th program consists of news, a news commentary music, and generally a greeting and recordin from an American serviceman in Korea to hi folks in the United States.

The station announces as "This is Radio Seou the Voice of Free Korea broadcasting from Seoul. The closing announcement indicates the prograr is on the air from 3.30 to 4.30 p.m. and 6.00 t 7.00 p.m. When closing the station states, "Thi broadcast is on the air twice daily, from 1330 t 2230 Pacific Standard Time and 22 to 2300 hour Hawaiian time, on HLK6 on 11,925 Mc/s. W invite our listeners to send a postcard or lette to the Voice of Free Korea, Korean Broadcastin System, Seoul, giving comments and suggestion on the program. Please join us tomorrow at th same time."

New Jap channels

THREE new frequencies, 11965, 17755 an 17855 Kc, have been added by Japan to it services in various transmissions throughout th world.

1.30-2.30 a.m., JOA4 11705, JOB21 15325; 3.30 4.30 a.m., JOA4 11705, JOB21 15325; 9.00-10.0 a.m., JOA24 17855, JOB21 15325; 3.00-4.00 p.m JOA24 17855, JOB21 15325; 4.30-6.30 p.m., JOA2 17755, JOB9 15225; 5.00-6.00 p.m., JOA20 17825 JOB5 15235; 7.00-8.00 p.m., on JOA4 11705 JOB20 9525; 7.00-8.00 p.m., JOA20 17825, JOB 15235; 8.30-9.30 p.m., JOA4 11705, JOB3 9675 9.30-10.30 p.m., JOA4 11705, JOB3 9675; 9.30 10.30 p.m., JOA23 17755, JOB9 15225; 11.00 midnight, JOA4 11705, JOB5 15235; 11.00-mid night, JOB22 11965; midnight-1.00 a.m., JOA 11705, JOB5 15235.

THE HAM BANDS WITH BILL MOORE

Radio Amateurs in many countries of the world have been co-operating in IGY projects by recording observations of radio signals and phenomena. Satellites provided the most interesting field last month.

E launching of the Russian satellite in early October provided a change for amateurs the normal run of DX, Raschewing, etc. were soon in the news with reports of their tion of signals from the satellite, the "bips" 20.005 and 40.002 mc/s were the most ed to programme for many days.

re in Australia we were particularly well d for reception, which was generally pos for two periods during each orbit, the on" passing directly over Sydney on a num of occasions.

me of the W stations, for instance, could hear it for 10 minutes out of the possible

ain problem of many amateurs was to stretch amateur band spread receivers the extra cycle, also there were a number of stations mitting "bips" at the rate of 20 per eight nds to make identification more difficult.

o of first amateurs to record reception in W, were Hugh Stitt, VK2WH, of Forbes, and Hill, VK2ADT, of Inverell. The latter, dur ne Sunday VK2WI broadcast, supplied full de on times of reception and how to iden the signals.

number of stations rebroadcast the "bips" ssist others to locate and identify the satel te transmissions.

any amateurs kept complete records on the ction and strengths of the signals, and these used to determine when the satellite was ng over Australia. VK3WIA gathered in ation from amateurs throughout Australia on signals received.

ost radio amateurs and amateur astronomers e organised for reception and observation of east-west 108 mc/s U.S. satellite (see elsewhere in this issue).

e Russian Moon and its south-north 40 and mc/s arrangement necessitated a change of to make complete observations.

series of simulated tests have been car out by N.S.W. amateurs to check the warning system they have set up to provide advance ce of the arrival of the Earth Satellite (U.S for the Sydney amateur astronomers.

ill James, VK2ER, in charge of the organis ation for the N.S.W. VHF and TV section trig off the test with an announcement on the 6-etre band at an unspecified time between d 8 p.m.

Urged warning stations Hugo Stitt, VK2WH Neville Wilde, VK2DR, in western N.S.W., mitted the warning back to John Miller, ANF in Sydney.

In then passed the warning to the amateur shomer station at Belfields, where 144 mc ipment of Horry Lapthorne, VK2HL, was operated by VK2ZBP, VK2ZCW, and VK2ZAV. The warning clock for the astronomers was started. The time elapsed for the warnings to arrive at Belfields varied from 1.5 to 2 seconds, which will allow the telescopes to be trained on the path of the satellite.

Gosford field day

THE Gosford Combined Newcastle Branch and Sydney W.I.A. Field Day will be held this year at the Gosford Sailing Club's rooms, an ideal location with picnic grounds and Olympic Pool close by. The date is Sunday, November 17. A full program has been arranged, including a scramble, 144 Mc/s hidden transmitter search, competitions for the OMs. The XYLs, YLs and Junior's entertainment will be catered for. Disposals equipment will be available.

These combined events have been held annually for over 20 years with attendances of over 250 persons on occasions. Make the run to Gosford on Sunday, November 17, to meet your amateur friends; the family will enjoy themselves. Major Collett, VK2RU, is in charge of local arrangements. Any of the Gosford gang will supply further details.

Civil defence in VK4

AT 0830 hours on August 25 the Queensland Division of the W.I.A. Civil Defence Network went into action on a simulated test when an "atom-bomb" was dropped in the vicinity of the Brisbane Story Bridge.

Headquarters of the network was set up on Eildon Hill, Windsor, and the base station directed mobiles to the required areas.

The 144 and 7 Mc bands were used during a successful demonstration and further workouts of the C.D.N. will be arranged.

The VHF group's September hidden transmitter hunt was an evening affair. Les VK4LM hid the station at Mt. Stephens. Ross VK4ZAT, from Ipswich, was first to locate the transmitter, followed by Chris VK4ZAO.

Extensive rebuilding and designing of 56 Mc gear is being carried out by VK4WD, VK4TA, VK4ZAS, VK4JO and VK4ZAA, and the band should be alive with signals shortly.

Jack VK4JO, moved the "bugs" out of a disposals FM transceiver, converting it to AM.

Ramsay VK4AB returned from U.S.A. with some fine VHF equipment and conditions from Palm Beach to Brisbane on the VHF bands have been excellent. The above VK4 notes were contributed by John VK4ZAG.

WIRELESS INSTITUTE NEWS OF THE MONTH

fill vacancies occurring on the N.S.W. Divisional Council, amateurs Dave Duff, 2KO, and Ced Smith, VK2CD, were nomin Dave fills the position vacated by Roy VK2HO, who resigned. He needs no in roduction to Australian amateurs. A past sec ry of the division, he has built up a remark d record in contest operation. Of late Dave has been most active as engineer at VK2WI

d is ex-VK2QK and 3QG and on his recent sit from Victoria now operates as VK2CD leakes over the duties of treasurer. The retir ng treasurer is Vince Cahill, VK2VC, who ains carried on the work after the election of new council in April.

ins Rucket, VK2AOU, lectured at the Sep ber meeting of the N.S.W. Division, his sub ct "Selectivity in Transmitting Circuits." ins provided the answer to a number of ries on transmitter design.

e retention of our current amateur bands the Geneva Telecommunications Conference discussed. Graham Hall, VK2AGH, spoke the advisability of direct amateur represen n at the ITU conference. It is anticipated n extensive organisation will be necessary to vent an effective case for the radio amateur.

important decision made at the meeting to employ clerical assistance for the secre y.

d is a forward step in W.I.A. organisation N.S.W. and should speed up routine paper

e division's A.O.C.P. classes will recom ce on Wednesday and Thursday, November d 7, when the first of the series of 46 lec s will be presented. Lecturer will be Leon Smith, VK2AOJ, who previously conducted the classes. All phases of radio theory, regulations and Morse instruction required to qualify students for the amateur operator's ticket will be covered. Classes will be held at the Railway Institute, Castlereagh Street, Sydney, and intending amateurs can direct their inquiries to the Class Manager, W.I.A., Box 1734, G.P.O., Sydney.

The Disposals Committee of the N.S.W. Division has been very active in recent months, as members are well aware, on procuring some excellent equipment. The committee comprises Harry Solomons, VK2AJZ, who acts as secretary, and Allan Williams, VK2FH, and Alec Dan, VK2ABU who are responsible for the purchasing.

Representative of the N.S.W. Division of the W.I.A. at the Civil Defence School at Macedon, Victoria, in October, will now be Bob Godsall. VK2ARG, who has taken over the position of CDEN organiser from Roy Hart, VK2HO. Bob has also been appointed Federal councillor for the division.

A number of DX-peditions are being arranged for a variety of the choicer prefixes. Some of them that are listed are as follows:—Ascension Island operation will be arranged by W6HNX and Co., 11ni will be visited by EA9DF and friends, and Bechuanaland by ZE3JO. HA5AM and OK1MB are lining up operations in Albania, while W6AWT and I1ADW are arranging visits to San Marino.

W6UOU hopes to operate from ZM7 and VR5 shortly.

Other locations likely to be visited in the future include Monaco, Svalbard, Alands and Corsica. The DX gang should be provided with some interesting contacts and QRM. The above information is according to Rod Newkirk, W9BRD, QST DX Editor.

Amateurs in the 20's

THE following details of radio activity in the early 1920s were obtained from newspaper cuttings and while they do not provide a complete record they give an indication of amateur radio work during those years.

It was reported that during Transtasman tests in August, 1923, Chas. Maclurcan 2CM's station was heard by amateurs in Honolulu.

Broadcasting commenced in Sydney in December, 1923.

Farmers was the first station opened at a cost of £16.000. Amateurs were invited to co-operate and provide written reports on reception throughout the country.

Plans for Jack Davis, 2DS, and Chas. Maclurcan, 2CM, trip to America on the Tahiti were made in late 1923. During this trip they recorded signals from many Australian stations and showed the value of short-wave communication with low powered equipment over long distances.

At this stage sets purchased from dealers except those bought by licensed experimenters were sealed. It meant that one could only receive one station and fees were payable to the station concerned. Extensive criticism was levelled against this method of reception on the then broadcast band and as in New Zealand most countries avoided this exclusive system of receiving.

Later in the month the first free broadcasting station "Broadcasters" was opened by a Sydney newspaper.

RECORDS BROKEN

Amateurs broke a number of interstate records during this month when a Melbourne station with seven watts input based its messages to two stations in Sydney and one in Melbourne.

In February, 1924, a list of the addresses and secretaries of 37 radio clubs was published. Some of these club secretaries are still active amateurs and include Bill Zech, VK2ACP, of Katoomba, Arthur Gray, VK2IJ, of Killara, and Lionel Swain, VK2CS, of Newcastle.

Opposition was rising against sealed sets and an article in the Sydney "Sun," January, 1924, urged that a blanket fee should be charged by the Postal Department and divided up among the broadcasting stations.

In the Sydney "Sun," April 5, 1924, it was stated that Australian amateur 3BM was transmitting special signals on 100 metres intended for reception in England.

"The Evening News," May, 1924, carried an announcement that the Federal Cabinet had removed the restrictions on sealed broadcast sets.

The first Federal convention of the Wireless Institute of Australia (then the Australian Wireless Institute) was held in Melbourne on May 17, 1924. A Federal executive was formed and each division contributed £20 toward the executive's running costs. Delegates included Max Howden, VK3BQ.

In June, 1924, an argument was in progress in the pages of "The Sydney Morning Herald" on the subject of whether Sir Ernest Fisk was the first person to hear telephony signals from England. The other claimant for the honour was Ray Allsop.

KGO MOST POPULAR

He had heard B/C station 5IT, Birmingham, on April 9, and again on April 24.

KGO was the most popular American station on the broadcast band and many amateurs had heard this station with single valve receivers, and two valves afforded loudspeaker reception on occasions.

Sealed sets were ruled out in July, 1924, and licence fees were payable to the Postal Department. They varied according to the distance of the receiver location from capital cities.

The charge for up to 250 miles was £1/10/ falling to £1 for the farthest country districts.

Experimental licences also varied in cost relative to distance. At a charge of £1 to 15/ they were issued to persons who possessed sufficient knowledge to undertake scientific research.

Main news in July, 1924, was the opening of the short-wave Beam Service between England and Australia. Comments on the virtues of the service were varied. Some of the claims for its effectiveness in view of present-day knowledge were rather far-fetched.

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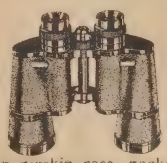

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wavelength of 90 metres was first used. ns were for a 200 times increase in signal th using the Marconi Beam system for trans- ion and reception.

August, 1924, the WIA Queensland Division nised the first wireless exhibition in that

orld-wide coverage by amateurs using the t-wave bands was nearly complete by this d. Contacts across the Pacific were com- place and in October, 1924, Ivan O'Meara, of Gisborne, New Zealand, worked across U.S.A. to Boston using a 50-watt valve.

was only a few days later that Frank Bell , of New Zealand, was to make radio history n he exchanged greetings with amateur Cyril ler in London. The two were congratulated e New Zealand Prime Minister, Mr. Massey, establishing the first wireless communication een England and New Zealand and the first -world contact. An input power of 150 watts used by 4AA and a wavelength of 90 metres e following month contact was established een N.S.W. and England.

k Davis, 2DS, and Chas. Maclurcan, 2CM the first amateurs to establish communica- , the English amateur being E. Simmonds.

The Australians used a wavelength of 86 s and 2OD, 95 metres. Two-valve regener t receivers were used for reception

exciting year on the short-wave bands was with amateurs pioneering world communica- They were gradually moving higher in uency and were soon to establish daylight ing around the world.

ithin a few weeks of these initial half-way t the world contacts other amateurs were ing consistently with England and other tries. Their pioneering work was receiving im in newspapers throughout the globe.

mmunication was established with England d daylight our time and it can still be re- d on the 80-metre band around the same of day provided firstly you can hear the G ugh the mass of commercial stations and dly you select the right morning

The 50Mc band

RTHER world-wide 50 mc IGY activity is being recorded and DX contacts on the band mounting. LA's are the latest amateurs to granted 50 mc privileges for the duration. t stations are operating extensively on their 40 mc/s band and are encouraging cross- contacts to 50 mc/s.

e G's and EIs are working 70 mc/s and ng for cross-band 50 mc/s contacts across the ntic.

3AC is active on 50 mc/s and stations in n, Okinawa, Midway, Kwajalein are operat- on the band.

e stations in the Pacific as well as many icans are listening on 56 to 60 mc/s for alian stations.

Amateur antenna towers

SPITE a number of precedents in favour of amateur antenna towers, a recent ruling e Court of Appeals of the State of New highest in the State, was to the effect that C could not erect a tower on his own erty. Zoning authorities had opposed the ication through a number of courts.

e ARRL had provided legal counsel in view e importance of the case.

is was in accordance with its policy of at- ing support in courts where results of cases affect the rights of all amateurs. The e had previously litigated through the high- courts of the States of New Jersey and Penn- ia the question of whether the amateur was an accessory use of residential prop- Both courts ruled that it is. Minnesota previously ruled in favour of the amateur

spite these rulings, in the last few years mber of amateurs have encountered diffi- s on the subject with zoning authorities. ing inspectors, etc.

e problem was particularly acute on Long d and New York State generally. The ular case of W2HC took two years to move gh the courts of the State and with the ect there are now conflicting laws in the ent States.

other States the highest courts ruled that ded he did not offend public health, safety orals, the amateur could erect any antenna ture in his backyard.

mateurs in Australia in isolated instances have applications for the erection of towers op- ed.

the majority of cases municipal authorities been sympathetic to amateur applications.

e ARRL and its general council are re- ing the present position and the possibility aking further legal action.

October field day

E two October holiday weekend events of the N.S.W. Division were well supported. e Sixth Annual Field Day of the Hunter ch held at Blackalls Park attracted 35 ama- plus associates, XYL's and families.

itors included two from interstate VK4FP VK4ZAE and country amateurs VK2APF, ANU and VK2AHH.

Winners of the various field events were as follows:—

First 144mcs Hidden Transmitter Search — Ken Mitchelhill VK2ANU.

Second 144mcs Hidden Transmitter Search — Geoff Partridge, VK2VU.

7mc Scramble — Frank Fowler, VK2APF.

All Band Scramble — Harold Whyte, VK2AHA.

The normal Sunday Broadcast of VK2WI was presented from the Field Day by State President Peirce Healy. VK2APQ, on Frank, VK2APF's mobile transmitter coupled to Tim, VK2AHT's AC and antenna.

The event was organised by Social Secretary Gordon Sutherland, Bill Hall, VK2XT, Chas Archbold, VK2ARV, and Varley Fitton, VK2SF.

The Spring Field Day of the N.S.W. VHF and TV section held on the Sunday was marred by extremely poor propagation conditions on the 144 mcs band. On the previous day conditions were normal but during the event a number of the usual longer distance 144 mcs paths were unworkable.

Stations in the Field included VK2OA at Mt. Canobolas near Orange, in the Blue Mountains VK2ANF, VK2AZO, VK2ZAB, VK2HL and in varied locations VK2ZBD, VK2ZAL, VK2VL, VK2ZCF and VK2ZBF.

At the time of writing it was difficult to obtain a true picture of the event as contacts were so limited and logs had not been compared.

The only country station in the Field was Keith Dodd, VK2ZAA, of Tumut located at Pilot Hill. He contacted VK2OA for the longest distance covered, 170 miles.

Country home stations operating were VK2WH Forbes, VK2JW Orange and VK2DR Blayney. In view of the distances covered and the amount of organisation entailed it was unfortunate to experience such adverse conditions.

NEW BOOKS

Radio for Models

"RADIO CONTROL OF MODEL AIRCRAFT AND BOATS," edited by Bill Winter for Berkeley Models Inc., New York. U.S.A., Paper cover, 72 pages, illustrated by drawings and cover photographs.

This excellently produced little book can be considered as a text for beginners in the art of radio control of models. The equipment described is the practical down-to-earth type of thing you could build and expect to work without the aid of a laboratory full of test equipment. At the same time it is well thought out and many, skilled in the electronic art, would find plenty to interest them. With one or two exceptions parts mentioned or their equivalents are obtainable in this country

The transmitter described is designed to work inside the 26.957 Mc/s to 27.282 Mc/s band set aside for model control by the authorities in this country but no mention is made of the 40.66 Mc/s to 40.70 Mc/s band available here. It is crystal controlled and would probably be approved by the local Radio Branch, which, by the way, should be notified before experiments begin. Note that the power here is limited to 2 watts rather than 5 watts as in the U.S.A

Our copy from the Technical Book and Magazine Co., 295 Swanston St., Melbourne. The price is 17/6 plus 1/ postage. (M.V.F.)

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More Radio Control

"RADIO CONTROL MECHANISMS," by Raymond F. Stock published by Data Publications Ltd., London. Paper cover, 64 pages, illustrated mainly by line drawings

Compiled from articles appearing in "The Radio Constructor," the book deals mainly with the mechanical side of the control of model aircraft, ships etc. Individual chapters deal, in considerable detail with topics such as relays, escapements and selector mechanisms. The approach is practical dealing with present day components and the adaptation of disposals parts. It would appear that the author has had extensive practical experience in the field of model control.

Our copy from the Technical Book and Magazine Co., 295 Swanston St., Melbourne. The price is 6/9 plus 6d. postage. (M.V.F.)

★ ★ ★

About Loudspeakers

ROLA LOUDSPEAKER DATA. Rola Company (Aust.) Pty. Ltd., July, 1957, soft cover, 47 pages, 8in by 5in.

A free booklet covering current Rola loudspeakers, speaker transformers and giving suggested details of speaker cabinets, this publication will be of great assistance in selecting the type of speaker best suited to your requirements.

A total of 24 Rola speakers is described ranging from the tiny model 3C to the model 12Ux high fidelity unit.

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U.H.F. TUBES FOR COMMUNICATION AND MEASURING EQUIPMENT. Book XI of the Philips Technical Library series of books on electronic tubes. Hard cover, 60 pages, 9in by 6in. Illustrated by photographs, line drawings and tube characteristic curves.

Largely a collection of data on U.H.F. tubes, the book contains the type of information that would be expected in a tube data book. There is also some descriptive information which will be of assistance in the practical application of the tubes.

The chapter on the standard noise source tubes and the use of standard

(Continued on Page 111)

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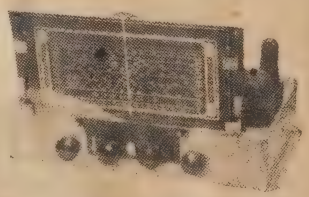

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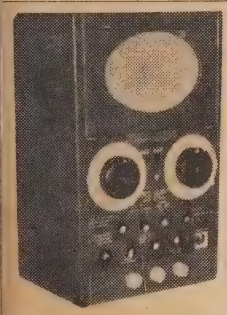

AR8 Communications Receivers

2 valve. Converted to 240v. A.C. Thoroughly Tested, Re-aligned. Latest Ovaltone Permag Speaker

£34/17/6

Type T3 press to talk Carbon Microphones

NEW

12/6 ea.

NEW 24V MOTORS

eries wound Hi-speed miniature 2.000 RPM £2/10/-
hunt wound with gear box, 2 speed nd 5 and 25 RPM £2/10/-

12 VOLT GENERATORS

lew C.A.V. 80 amp. Generators. deal for lighting or fast charges.

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2v. 420 watt Prefocus Globes . 7/6

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All tested on TV picture

BP1 with shield and socket. £3/17/6
CR 97 . . . . . £2/17/6
CR2X and Shield . . . £3/0/0
V 112 White 5in . . . £3/10/-
V 254 9in Blue Screen. Magnetic Deflection and Focus

£4/10/-

very tube capable of perfect pic- ure. Fast persistence and simple onstruction using standard com- ponents.

NEW 3BZ TRANSMITTERS

2v. operation. 2 to 10 Megs. Air tested. Perfect order. omplies with P.M.G. requirements. or small ships, bushfires and all ther services.

COMPLETE WITH 1 CRYSTAL

£32/10/-

TRANSCEIVERS

lo. 11 less valves and meter. £3/-/- lo. 11 including valves and meter. £4/10/-

lo. 19 less valves and meter. £3/-/- lo. 19 including 15 octal valves and 00 micro amp. meter . . £5/15/- .B.: All these units are in excel- nt condition. For original use parts or conversion.

CO-AX CONNECTORS

2/6 ea. 25/- doz.

NEW VCR 139A C.R.O. TUBES £1/10/-

AR8-AT5—COMPLETE STATION

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Transmitter-Receiver, Aerial Couple Cables, Plugs, Phones, Mike. 1 Crystal to desired Frequency 24v. Power Supply and Circuits of 2 units.

GUARANTEED IN PERFECT ORDER

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Other voltages available.

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Johnston 300 watt direct coupled to 1 H.P. petrol engine. Tested. Perfect order.

£36.

NEW VALVES

217C	10/-	6E5	12/6
12C8	12/6	12K8	12/6
6J8	17/6	VT502	12/6
VT501	12/6	7A6	7/6
EBC33	12/6	VT1	3/9
1H6	7/6	832A	£3/-/-
6L6	20/-	6K7	7/6
1C6	12/6	12SJ7	12/6
1G4	12/6	12SK7	12/6
1D4	12/6	12SL7	12/6
1J6	12/6	39/44	10/-
1K4	12/6	46	12/6
1K6	12/6	47	12/6
1LH4	12/6	78	12/6
1P5	5/-	828	£2/10/-
6A6	12/6	843	£1/10/-
3A4	15/-	957	10/6
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12A6	12/6	RK48A	£3/-/-
2A3	£1/-/-	954	7/6
KTW62/6U7	7/6	VR105/30	15/-
1M5	7/6	1C7	4/6
1D5	7/6	1T4	12/6
CV6	3/6	1A5	7/6
6F6	12/6	7193	3/6
VR65A/SP41	2/6	829B	£3/-/-
KT66	27/6	6G8	15/-
806	£3/10/-	6B8	12/6
6W6	12/6	807	£1/-/-
1K7	7/6	EL3NG	12/6
6X5	10/-	866A	15/-
1Q5	6/6	6AC7	3/6
8U1	£1/-/-	EF50	3/6
X61M	17/6	100TH	£2/5/-

NEW COPPER OXIDE RECTIFIERS

24v. 100mA BRIDGE. Ideal for trickle Chargers, Relay operation, etc.

2/9 ea. 25/- doz.

NEW 5FP7 C.R.O. TUBES

Ideal for flying spot and closed circuit TV experimenters.

17/6

New Microswitches

6/6 each

Postage 6d

NEW INVERTERS 200 WATT

50 cycle. 24 and 32v. D.C. to 240v. A.C. Ideal for radiograms, etc.

£25/-/-

NEW TRANSFORMERS

FERGUSON

VIBRATOR TRANSFORMERS

150 x 150 40mA, 6v. . . £1 4 6
300 x 300 100 6v. . . . £1 17 6
325 x 325 125 12v. . . . £3 12 6

Inverter Transformers

6v., 240v. 40 watt . . . £3 7 6
12v., 240v. 60 watt . . . £3 7 6
32v., 240v. 60 watt . . . £3 7 6

C.R.O. TRANSFORMERS

350 x 350 extended to 1000v. 6.3v., 6.3v., 215v., 4v. . . £4/5/-
Postage: N.S.W., 5/-: Interstate, 7/6.

New A.R.B. Receivers

8 Valve

4 Band, 195 KC to 9.025 Megs

24v. D.C. Operation . . £22 0 0
Converted for 240v. A.C. £33 15 0

RELAYS

6v. 3Pie Miniature 15/-
1700 SPDT 7/6
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12 volts DPDT 5 amp . . £1/-/-
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Hi-speed Polarised relay. £2/10/-
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½in Square Section DURAL TUBING UP TO 12ft lengths, 1/- per ft.
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100 yards £2/17/6
Tx Var. Condensers, 300 pf. £1/5/-
100 pf. £1/1/-
60 pf with Vernier . . . £1/1/-
30 pf 10/-

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8in x 7in x 6in deep. Hinge Lid.

Price 7/6

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New Electric 24v to 32v Hydraulic Pumps

Heavy duty motor develops 1 h.p. cont. 2 h.p. intermittent. Ideal motor for operating power tools off 32v. D.C.

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O.P.T.X. 500 and 1000 fitted. New condition. **£22/10/-**

NEW HIGH IMPEDENCE HEADPHONES

£1/10/-

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New Smith Aircraft CLOCKS

8-day movement. Cost Govt. £28.
2¼in £4/15/-
2¾in with sweep hand . . £5/15/-

New Coils and Intermediates Standard or miniature to suit all valves

Coils B/C 455 KC 9/6
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GENEMOTORS

Input	Output			
24v	250v 100mA	£1	0	0
24v	550v 375mA	£2	0	0
24v	250V 60MA	£1	5	0
12V	500V 350MA	£8	10	0
12V	1200V 200 MA	£6	10	0
6V	500V 150MA	£6	10	0
24V	250V 100mA New	£2	0	0
12V	235V 50Ma	£2	15	0
12V	350V 50MA	£2	15	0

3BZ STATION

TRANSMITTER AS ABOVE.

Receiver 5 Band. 200 KC to 30 Megs, includes speaker and all accessories.

£92/10/-

TELEPHONES

Standard P.M.G. Type

Pedestal Magneto Phones tested in perfect order.

£6/10/-

RECORDING TAPE

E.M.I. and Scotch Hi. Coercivity Excellent Condition. Ex. ABC.

1200 ft. Spools	£1	8	6
600 ft. Spools	18	6	
3250 ft. Platters	£2	10	0

Dynamic Headphones

PADDED EARPIECES

£1/1/-

Dynamic Microphones

in hand set with pressel switch.

17/6

TRANSCEIVERS NEW No. 122 & 22

2 to 8 megs as above. Converted to Crystal Control. Power increased to 20 watts. Includes Plugs and Cables. Mike, Speaker, Circuit. 2 Crystals to wanted frequency conforms to P.M.G. requirements for small ships and other services. **£33/17/6**

WANTED

Communications, Receivers, Test Equipment, P.A. Gear. Large or small surplus stock. Best prices. Call, write or phone any time.

Oil-filled Condensers

1UF 600V 6/6 5UF 2.5V 6/6
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10MFS 500 7.5UF 330V AC 10/-

12V GENEMOTORS

550V 55MA
275V 110MA } OUTPUT

£2/15/-

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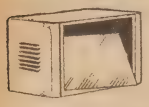
NOW AT 179 FLINDERS LANE, MELBOURNE, C1. MF2582★

INSTRUMENT and AMPLIFIER CASES



Receiver type, vented takes 8in x 5in chassis, with removable front panel as illustrated. Inside height, 6in Steel black crackle finished. Front rounded corners. Part No. 4C12 31/6. Plus Post 4/.

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SQUARE STEEL CASES. Square Corners, No Louvres.

9in x 7in x 5½in deep Part No. 4D2	20/6
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Postage 4/ extra

Germanium Transistors and Diodes

(Get PHILIPS book "Transistors and Germanium Diodes" Price 6/6. Post Free.)

OC70 28/9, Post Free

OC71 28/9, Post Free.
OC72, 50/6, Post Free.

OC72 (Matched pair for push-pull circuits) 100/-. Post Free
4A42 Germanium Diode 10/. Post Free

Experimenters . The OC16 Push-Pull Class B Transistor gives high power output from a 6v or 12v accumulator.
With 12v supply gives 10 watts into a 33 ohm load
With 6v supply gives 6.4 watts into a 13 ohm load.
Limited supplies £5/18/4 Post Free

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ALUMINIUM CHASSIS

Spot Welded Ends

6 x 4 x 2	4A13	7/6
8 x 5 x 2½	4A14	10/-
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First grade aluminium, carefully turned corners, easy to drill or punch Special sizes 50 p.c. more

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Expanded Aluminium

Suitable for speaker grills, etc., can be used natural or sprayed any colour:

13½ x 27in Alum	30/-
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½ sheets available. Pack and post, 2/-

NOTE. We have in stock parts for all Radio and Hobbies circuits Full stocks of Rola, Ironcore Ferguson, Kingsley, Philips, Mullard, Radiotron, Q-Plus, Oak, Jabel, Roblan, RCS, AWA, Efco Scope, A&R, Eveready, Diamond, Ducon, IRC, Erie, Aegis, Birko and other local and overseas products Use our Fast Quote Service.

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For quickest possible service, write on the left-hand side of a sheet of paper the radio parts that interest you — one beneath the other. If a kit, itemise. Add your name and address and send it to us with a stamped, self-addressed envelope. We will add the latest prices and return to you. Use this sheet as your order form and return to us with remittance for cost and postage as quoted. Goods will be sent same day. Any surplus refunded. Sorry, no C.O.D

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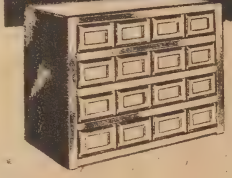
Also Nos. 130-131-132-135-138-140-141-142.

Read back of any book for other publications.

STOP! FIND THOSE LITTLE THINGS FAST!



Model A—Cabinet 12in x 9in x 5½in. 16 drawers 5½in x 2 5/8in x 1½in.

Mod. B 4 drawers 11in x 5½in x 1½in.
Mod. C 4 drawers 5½in x 5½in x 3½in.
Mod. D. 8 small and 2 long drawers.
Mod E. 8 small and 2 square drawers
Mod F. 4 small, 1 long, 2 square drawers.
Mod G. 9 drawers 5½in x 3½in x 2 1/8in.
Mod H As Mod A—but fitted with divisions.
Mod J As Mod B—but fitted with divisions

Send self-addressed stamped envelope for illustrated leaflet. These all-steel COLRAD craftsman-built handy cabinets attractively finished in baked grey hammertone enamel with provision for fitting name notification card on each drawer.
A strong and most useful cabinet for holding small parts or tools. Ideal for mechanic, engineer, garage or home workshop Provision is made for stacking into units. **48/-**
OVERALL SIZE 11½in wide, 9in high, 5½in deep.
Postage: Vic., 3/8. N.S.W., A.C.T., S.A., Tas., 6/-; Qld: W A N T 8/4

THE NEW! "Q-PLUS" CRYSTAL SET

- PERMEABILITY TUNED.
- LITZ WIRE COIL.
- GERMANIUM DIODE DETECTOR.
- COMPACT.
- PLASTIC CABINET. 5in x 3in x 3in.
- THE MIGHTY ATOM.

EXTRAS:—
100ft Aerial 7/6
BROWN'S Sensitive Phones 49/6
or 4K17 Disposals Phones 25/-

49/6
PLUS 2/- POSTAGE

EVERYTHING FOR THE RADIO AND ELECTRICAL EXPERIMENTER

ALL ABOUT AUDIO AND HI-FI

(Continued from Page 37)

atural tendency is to adjust the balance y turning the weaker ear toward the ource of sound, so that quite wide varia- ons could exist in one pair of ears with- it disqualifying the owner from a rewd exercise of tonal judgment.

Quality No. 3: As with the gift of erfect pitch, the main basis of tonal scrimination is memory, coupled with e ability to hear and recognise res- nances, harmonics, transients, and all e other qualities which go to make a musical picture, plus a sensitive action to any form of distortion.

An appreciation of music and regular oncert-going to keep the ears fresh are vious advantages. Anybody who un- ittingly plays records too loudly or o softly is disqualified from the start, id it does not matter whether his am- ifier is 10 watts or 100 watts. The arger than life" platoon cannot be ad- itted into this select company.

ONAL JUDGMENT

Again in common with the gift of tch, you either have tonal judgment you have it not, and it is easily cognised in listeners when demonstrat- g sound equipment to various people, spite of enormous variations in pre- rence and taste. A spark of the talent -and talent it undoubtedly is—can de- lop into a flame by regular use.

I suppose the most skilled in the art e recording engineers who almost daily mpare live with recorded speech and usic and can recognise on a monitor eaker which piano out of a half a zen studio models is being played.

My complaint is that recording engin- rs hardly ever write about their acti- ties (probably due to hush-hush policy) views on the subject are left to be red by semi-skilled but interested par- s like your humble servant.

MUST BE WATCHED

The most difficult application of tonal dgment — after recognising that some- ing is wrong — is the ability to recog- se where the trouble originates.

Poor recording, bad studio acoustics, e distortion, antenna or reception ults on FM, pickup distortion, ampli- r faults, speaker trouble, listening om coloration, wrong setting of play- ack characteristics, wrong volume vels; these and many other sources of ror need watching before final per- rmance can be fairly judged.

For instance, the quality from FM at s best is so good that any short- omings in the quality of program ma- rial are ruthlessly exposed on wide- nge reproducers. A poor record via M may sound as though the loud- eaker is out of centre, and may actu- ly sound better on a small speaker in resonant cabinet than on a hi-fi system.

So we will conclude this article by ating that tonal discrimination is the ost vital quality of the ear in audio tivities, and that it involves placing a urce of distortion quite as much as oticing it. In short, do not always blame e loudspeaker.

In our next article, we will have a ok at room effects.

(To be continued)

HERE'S THE ANSWER, TOM!

(Continued from page 41)

In our constructional articles we make it a point to suggest earth lugs under various mounting bolts and suggest that you follow this practice. These lugs may be later joined by a run of heavy tinned copper wire and the various leads of components which need to be earthed may run to the nearest earth lug. There are some exceptions which we must mention. High gain stages, such as pickup and microphone preamplifier stages, often require earth returns grouped to a common point and are invariably shown thus on the circuit.

This is necessary to prevent eddy currents in the chassis from getting into these high-gain circuits and causing hum. It is frequently a good idea to keep the power supply earth point well separated from the earth point on these stages.

Another notable exception is that of circuits operating at VHF and UHF. In these circuits it is often quite important to return earths to a common point by the shortest and most direct route possible. It is customary to select an earth point, generally near the cathode, and return to it all the wiring and components that have to do with that stage.

We normally show separate earth points but do group those which occur side by side in the diagram. When a circuit calls for single point earthing we make an effort to indicate that in the circuit as well as to mention it in the text.

★ ★ ★

Since rubber has insulating properties, how is it that radio waves can get through the insulation to the wire in the case of an aerial made of rubber covered wire?

This is a question that has puzzled many beginners and apparently you are no exception, Tom.

When dealing with simple electrical circuits metallic contact is necessary between wires and components to complete the electrical circuit.

However, radio waves are quite different for the energy they contain consists of electromagnetic and electrostatic fields. These fields can exist in space and are not impeded by ordinary insulating material. To give you an analogy that you will understand, a magnet will attract a needle or other ferrous metal objects through air, through a shet of paper or, if the magnetic lines of force are sufficiently strong, through a table top.

In the same way radio waves can induce currents in a wire suspended in space and having an insulated coating of some thickness.

ULTRON 15 series

TAPE HEADS *Extraordinary*

FEATURING:—

★ Extreme Frequency Range.
(20 cps. to 20,000 cps. at 7.5 ins. per sec.)
(20 cps. to 30,000 cps. at 15 ins. per sec.)
★ Triple Magnetic Shielding (—30dB at 50 cps.)
★ High Output.
★ Micro-aligned Gap (record and play with separate heads with no treble loss).

THE ULTRON 15 series is recommended for:—
★ Professional Transcription.
★ All Laboratory Uses.
★ Full Frequency Reproduction of Pre-Recorded Tapes.

By far the most advanced range of tape heads available, the ULTRON 15 series is produced in the following types: —

ULTRON 15, ULTRON 15T, ULTRON 15L. Record-Play, high impedance, .00017in gap.
ULTRON 15H, ULTRON 15HT, ULTRON 15HL. Record-Play, medium impedance .00017in gap.
ULTRON 15S, ULTRON 15SI, ULTRON 15SL. High-Efficiency Record. .003in gap.
Note—"T" denotes standard half track: "L" denotes lower half track. All others are full track.

SEND 4/- POSTAL NOTE FOR BOOKLET "MAGNETIC TAPE HEADS," containing full specifications of all LB Products' tape heads. Hi-Fi Tape Circuits, etc.

A FREE COPY IS SUPPLIED WITH EVERY HEAD.

Retail Prices: ALL ULTRON 15 series £9/13/6
Types HE2, HE2T (record-play, commercial quality) .. £6 /3/-
Types EU, EUT, EUL (high efficiency erase) .. .. £5 /7/-

Available from:—
Victoria:—Homecrafts Ltd., 290 Lonsdale St., Melbourne.
S. Aust.:—A. G. Healing Ltd., 58 Flinders St., Adelaide.
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MANUFACTURED SOLELY BY LB. PRODUCTS, 95 McDONALD ST., MORDIALLOC, S.12, VICTORIA. Phone XY1596.

No. 22 & 122 TRANSCEIVERS

The 122 transceiver covers a frequency of 2 to 8 Mcs. and has been approved by the P.M.G. for use on fishing boats, small craft, bush fire brigades etc.

THESE SETS ARE SUPPLIED COMPLETE WITH VALVES. 12v. VIBRATOR POWER SUPPLY, DYNAMIC HEADPHONES AND MICROPHONE, 6in. x 9in. OVALTONE SPEAKER, LEADS, SPARE KIT OF VALVES AND TWO CRYSTALS TO REQUIRED FREQUENCY. RANGE TO 300 MILES. SETS AIR TESTED. **£40/-/-** F.O.R.

THESE UNITS IN NEW CONDITION.

The 122 transceiver as above but less crystals, speaker and spare valves not air tested

£18/-/- F.O.R.

The 22 transceiver as 122 but not converted for crystal control, supplied with valves, meter, power supply, dynamic headphones and microphone. **£15/-/-** F.O.R.

No. 19 TRANSCEIVERS

These units cover a frequency of 2 to 8 Mcs and contain 15 6.3 volt valves including 1-807, 2-6V6, 6-6K7, 2-6K8; 6B8 etc., also 500 micro-amp. meter.

UNITS SUPPLIED COMPLETE WITH VALVES, LEADS, JUNCTION BOX, GENEMOTOR POWER SUPPLY AND DYNAMIC HEADPHONES AND MICROPHONE (operate from 12v supply). AIR TESTED. **£16/15/-** F.O.R.

TRANSCEIVER ONLY SUPPLIED WITH VALVES AND METER. **£5/15/-** F.O.R.

SET OF LEADS AND JUNCTION BOX FOR No. 19 TRANSCEIVER **20/-** plus post and packing 10/-. 12 volt GENEMOTOR FOR 19. **£2/15/-** F.O.R.

NEW 3" R.F. METERS. 350MA or 1AMP

These meters can easily be converted to 10 or 100 mA. meters, new scale supplied with meter. **7/6** Post 2/6

BUILDING R. TV & H. 5in TV SET

ALL MAJOR PARTS IN STOCK INCLUDING R.C.S. IF STRIPS & TUNERS, VALVES, POWER TRANSFORMERS, CHASSIS, ETC.

511A C.R. TUBES

These 12in tubes have been recommended for TV use in "Radio World," uses same sockets as VCR97.

£5/11/6 F.O.R.

NEW DYNAMIC HEADPHONES

These headphones made by Rola are a high quality unit giving excellent tone. Fitted with comfortable ear pads.

27/6

Post 4/6

NEW DYNAMIC HAND MICROPHONES

These are a sturdy moving coil microphone made by Rola in bakelite case with switch.

25/-

Post 3/-

VALVE SPECIALS

20/- will purchase any one of the following valve Specials

2	EL36G	3	6K8G
3	1P5	5	6SH7
5	1C7	6	6AC7
3	1Q5	4	6J7G
10	1KS	4	KTW62/6U7
5	954	4	12A6
6	EF50	2	6X5GT
4	6C8G	5	6K7G
10	VR65A		

Post and Packing, 4/6 extra

ALL VALVES ARE NEW

NEW 6H6 OR 6H6GT VALVES

Individually Cartoned

20/- per doz.

Post 2/6.

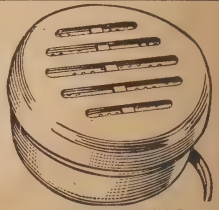
NEW TRANSMITTING VALVES

829B	£3	0	0
100TH	£1	10	0
866		15	0
811	£1	0	0

NEW 2½in C.R. TUBE

Type VCR 139A

£2/10/-



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Well worth 35 gns.

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★ SPECIALS ★

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ANSWERS TO CORRESPONDENTS

E.W. (Dubbo, N.S.W.) writes to tell us of his eriences in the audio field and express his isure in reading various articles particularly se dealing with audio equipment. He confirms opinion in a very practical way by forwarding ubscription for another 12 months.

Yours is one of the letters we enjoy receiv We note the remarks regarding the audio ipment and your reaction to a comparison with commercial equipment with interest. Glad to note that you find the record reviews of stance in selecting new lines and to add to your ection. The subscription has been recorded he usual way.

B.A. (Adelaide, S.A.) relates that a friend of purchased one of the commercial gadgets med to be equivalent to a 100ft aerial. Curiosovercame him and on taking it to pieces he nd that the aerial and earth wires were simply nected to the earth terminal and that the decontained no other apparatus. He wonders his is satisfactory.

We need make no comment other than to that the fact that the device works at all says t for the sensitivity of modern receivers and obility of mains and earth wiring to pick up als.

R. (Broken Hill, N.S.W.) is interested in the sistor set described in the June issue and sends a circuit from an overseas magazine showing a simple amplifier may be added.

Many thanks for your letter G.R. and for trouble you have taken to send us the circuits you probably realise, we already had somelike this in mind, and it was described in the issue. In general it is easier to work from designs, since they are intended, as far as ible, to suit the local supply position.

V.P. (South Perth, W.A.) sends a subscrip for 12 months and makes a few enquiries t transistors. In particular he wants to know transistors are not being used in commercial since they appear to offer so many advantages.

Many thanks for your subscription R.V.P we have forwarded this to the appropriate dement. Transistors are not in general use in country at the present time for a number of ons. One is the problem of supply, as conled by import restrictions.

H.S. (my Trienza, at sea) is very interested the Dual Wave Radiogram described in the issue and suggests that we might use this unit as a basis around which to design a set e in the line of a communications receiver make several suggestions as to the additions modifications which could be made.

Many thanks for your letter J.H.S. and the estions it contains. We will certainly keep this in mind and may be able to describe someg along these lines in the future. At the same s, the use of a commercial coil unit deed essentially for standard dual wave sets may ent a serious problem in the matter of bandlad, adequate coverage, etc. Best of luck with radio venture on Ocean Island.

H. (Shepparton, Vic.) describes how he modi his crystal set to give better results. Essentithe changes consist of eliminating the usual ings from the coil and connecting both aerial earphones directly to it.

While this arrangement may sometimes im e results we feel that the local conditions are e than usually favourable. Normally the addial loading of the aerial and phones will so re e the "Q" of the coil that selectivity will suffer while the actual signal strength may also reduced, in spite of the closer coupling.

J.T.M. (Wollongong, N.S.W.) inquires about statement in the article in the June issue arding the power handling capabilities of tran ors.

We are not sure of the statement you have mind, but briefly, the power you have to sider is that reaching the transistor from the ery, and provided you follow the circuit given, need have no fears on that score. Unless are literally within a stone's throw of a erful transmitter you need have no fear that dio frequency power from the aerial will damage transistor, even if it is 100 feet long.

L.R. (Fitzroy, Vic.) has been advised that the dio Service Manual has ceased publication and nts to know whether there is any chance that will be taken over by any other organisa n.

We agree, H.R. that these books were y handy, but we know of no move to or ise their publication by any other firm. How r, thanks for the suggestion and we will p the idea in mind.

H. (Kensington, Vic.) sends a question for Answer Tom page concerning the 1957 Little ieral.

Your question is rather too specialised for the Answer Tom page P.H. this being reserved for problems of general interest. Without more details of the speaker it is impossible to say whether it would be suitable for use in the circuit. In particular, we would need to know whether it was a permag. type or one of the older electro-magnetic variety. In the latter case it would not be suitable. The transformer value of 2000 ohms is rather unusual and not really suitable. However, it would be perfectly feasible to fit the correct transformer. The tuning capacitor also sounds somewhat unusual, but we suggest you use the two 10-plate sections only. A loopstick aerial is a long ferrite rod carrying a resonant winding which replaces the aerial coil.

S.J.A. (Mt. Gambia, S.A.) is anxious to add the audio end of the D/W Standard Radiogram to an existing set, but is worried as to how to connect it to the present 6G8 detector and first audio stage.

A. The main objection to the scheme you propose is that you would be providing an additional audio stage, which could easily make the total audio gain embarrassingly high. This could result in instability, hum, noise, overload, and similar troubles. It would probably be far better to take the audio signals directly from the existing volume control to the input of the new amplifier, using the 6G8 as a detector only. Alternatively, this could be replaced with a 6H6. These are available very cheaply at the present time.

S.S. (Parramatta) writes to tell us of experiments with small sets.

A. Thanks for your letter and for your account of what you are doing. Your attempts at recording them rather venturesome but best of luck, anyway.

G.R. (Broadmeadow, N.S.W.) has been intrigued by the designs for transistor portable receivers current overseas. He would like to build one, but wonders about components and constructional information.

A. We would very much like to publish the design for a full size transistor receiver, but the supply of components, particularly high frequency transistors, at the moment is such that it would be completely impractical. A few months ago we described a small transistor receiver which required only one high frequency transistor. The response was immediate and it was only a matter of days before people were ringing to say that they could not buy the transistor. You can imagine, therefore, that it would be extremely foolish for us to describe a larger receiver, and we cannot suggest where you could obtain information on a receiver to suit local conditions elsewhere.

I.J.S. (Hawthorn, Vic.) sends in a query for the Answer Tom feature regarding the fraction stamped on the bases of valves.

A. Since there is no technical reason for these figures, I.J.S., we feel that your answer is more suitable for this page. The figures 4/-, etc., are an excise stamp and refer to the factory in which these valves were manufactured.

C.H.S. (Forest Lodge, N.S.W.) wants to know if it is possible to charge a small 4V accumulator from a 12V accumulator and what size resistor would be necessary to achieve this. He also suggests that we publish more on the electronic side of photography.

A. It is not possible to calculate the correct value of resistor exactly, C.H.S., and, in any case, charging by this method would not give a constant rate of charge. We suggest a resistor of 20 ohms as a basis for experiment, but it would be advisable to check the charge rate with an amp meter. We have published many articles in the past on electronic flash units, both high and low voltage types, as well as an electronic photo-timer. No doubt we will publish other photographic articles in the future as time permits, though at present we are rather snowed under trying to keep pace with the demands of T.V., etc.

M.R. (Northbridge, N.S.W.) wishes to obtain back issues of our magazine which contains articles on transistors and transistor circuits, preferably powerful enough to work a loudspeaker with reasonable volume with a short aerial.

A. Three experimental transistor sets were described in the June, July and August issues of 1955, the last of these was capable of driving a loudspeaker at good volume since it boasted a push-pull, class B output stage. It required very strong input signals, however, since there was no regeneration to boost sensitivity.

We regret that we are unable to supply any of these issues, but circuit reprints are available from our files. We suggest that you contact one of the advertisers on the classified ads. page, who frequently advertise back copies at reasonable cost.

G.C.F. (Caloundra, Qld.) asks, "what is the minimum signal voltage required to give a good clear, steady picture on an average commercial T.V. receiver?" He also asks a similar question regarding F.M.

A. Either question could be the subject of a long discussion, definition of terms, etc. For example, what do you mean by R.F. voltage? The peaks of the sync. pulses? What is a clear, steady picture? Probably it would be of the order of 100 uV, but we would be quite happy to be corrected on this one. The figure for the F.M. receiver would depend on the deviation of the system, but would probably be somewhat less than this.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

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Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cut-outs in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

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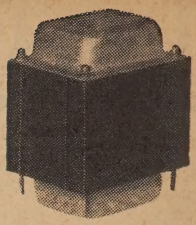

NEW PREFERRED RANGE

First introduced by FERGUSON early in 1955, the PREFERRED RANGE of transformers and chokes covers the most popular types, selected from the vast FERGUSON range. Production is concentrated on these types to ensure prompt delivery.

The PREFERRED RANGE is now being revised, and the new PREFERRED RANGE of POWER TRANSFORMERS is listed below. Filter chokes, output transformers and vibrator transformers will also be revised.

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PF545	240	350-0-350 650V	20 2	6.3V-3A, 6.3V-0.6A 4V TAP 2.5V-2A
PF619	240	150-0-150	30	6.3V-1.8A
PF299	240	285-0-285	40	6.3V-2A, 5V-2A
PF300	240	325-0-325	40	6.3V-2A, 5V-2A
PF201	240	225-0-225	50	6.3V-2A
PF151 PF151-F	230-240	285-0-285	60	6.3V-2A, 5V-2A
PF166	230-240	325-0-325	60	6.3V-2A, 5V-2A
PF165	230-240	385-0-385	60	6.3V-2A, 5V-2A
PF170	230-240	285-0-285	80	6.3V-2A, 6.3V-2A, 5V-2A
PF1073	230-240	300-0-300	80	6.3V-2A, 6.3V-1A
PF169	230-240	325-0-325	80	6.3V-2A, 6.3V-2A, 5V-2A
PF168	230-240	385-0-385	80	6.3V-2A, 6.3V-2A, 5V-2A
PF130	230-240	285-0-285	100	6.3V-2AC.T., 6.3V-2A, 5V-2A
PF164	230-240	325-0-325	100	6.3V-2AC.T., 6.3V-2A, 5V-2A
PF160	230-240	385-0-385	100	6.3V-2.5AC.T., 6.3V-2A, 5V-2A
PF1072	230-240	300-0-300	120	6.3V-4AC.T., 6.3V TAP5V-2A
PF152	230-240	285-0-285	125	6.3V-3AC.T., 6.3V-2A, 5V-2A
PF163	230-240	325-0-325	125	6.3V-2.5AC.T., 6.3V-2A, 5V-2A
PF181	230-240	385-0-385	125	6.3V-3AC.T., 6.3V-3A, 5V-2A
PF174	230-240	285-0-285	150	6.3V-2AC.T, 6.3V-3A, 5V-3A
PF142	230-240	325-0-325	150	6.3V-2AC.T., 6.3V-2A, 5V-3A
PF175	230-240	385-0-385	150	6.3V-2AC.T., 6.3V-2A, 5V-3A
PF173	230-240	425-0-425	175	6.3V-3AC.T., 6.3V-2A, 5V-3A
PF1067	230-240	400-0-400	180	6.3V-4AC.T., 6.3V-2.5AC.T., 5V-3A
PF1193	200-220-240	295-0-295	275	6.3V TAP 5V-3A, 6.3V-9A
PF1265	240	—	—	6.3V-2.25A
PF162	240	—	—	6.3V-3A, 6.3V-3A
PF265	230-240	—	—	17V, TAPS 11.5V, 10V, 8.5V-4.2A

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BOOK REVIEWS

Continued from Page 101)

se sources in the adjustment of U.H.F. ipment is useful and provides some ormation that may not be always easy find elsewhere.

Our copy from N.V. Philips, Gloei-npenfabrieken, Eindhoven, Holland. cal distributors for the book are ilips Electrical Industries P/L, 69 irence Street, Sydney.

★ ★ ★

bout Oscilloscopes

THODE RAY OSCILLOSCOPE, by rley Carter, A.M.I.E.E., Philips Tech-al Library Popular Series. Soft cover, pages, 8in by 5¼in. Illustrated by nerous photographs, circuits and wings.

An excellent introduction for those o have little or no knowledge of the illoscope. This little booklet covers the basic oscilloscope elements. A nber of fold-out circuits of complete truments show the practical aspect the points made in the text.

Our copy direct from N. V. Philips' peilampenfabrieken, Eindhoven, Hol-d. Local distributors for the book Philips Electrical Industries P/L, 69 irence Street, Sydney. The price is 6.—(M.V.F.)

ANSWERS TO CORRESPONDENTS

.T.D. (Narrandera, N.S.W.) sends in a num-of queries regarding IF transformers, the ration of a 6-volt car radio from 12 volts a suggestion for step by step constructional ails of multi-band DX receiver to be spread several issues. K.T.D. also has some com-its to make on his success with our battery ger and ends with a number of appreciative ments on our journal.

We note your kind remarks with pleasure and t that you will continue to enjoy our publica-. Your initial queries on IF transformers ld be of a general interest, and we have been to fit these into an Answer Tom feature.

rior to fitting a dropping resistor to the 6-volt radio, it is necessary to know the total cur-drain of the set. This will be several s since the heaters derive their supply from same source. An ammeter in series with of the leads should supply the answer and it is a simple matter of applying Ohm's Law ind the resistance required to provide the six s drop. The resistor will most likely have lissipate about 50 watts and should be mounted well ventilated space.

/e are pleased at your success with the bat-charger and note your suggestions regarding DX receiver. Due to other pressing matters are unable to consider your suggestion at the ent. However, we have described several ex-nt multi-band receivers and suggest that you le one of these. Circuit reprints are avail-through our query service.

.X.S. (Wallington, Vic.) writes to tell us of e experiments he has been conducting with idea of building a frequency modulating unit n a standard loudspeaker. The results appear mising so far, though it has not been possible give the unit the final check in the finished uit.

Many thanks for your letter, G.X.S., and r efforts so far sound most interesting. We ld be very glad to hear how the unit finally ks out, and, if you care to send us some e details, preferably with some rough ches, it may make a useful article for the ader Built It" page. From experiments we seen conducted so far it would seem de-ble to make the unit have approximately same capacitance range as the original, name-from 20 to 100 pf. It may also interest you know that some readers have successfully im-ed these units from the English firm men-ed in the June issue. With regard to your ested combination of time base, amplifiers, for the C.R.O. we would say that this ap-rs to be perfectly feasible. It should also possible to substitute the valves you suggest the marker generator, though we would not to assume that this could be done without e minor circuit changes. This could be de-ined only by experiment.

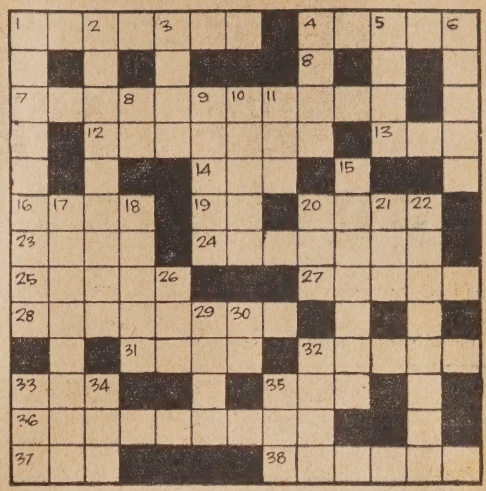
.N.T. (Penang, Malaya) asks some questions ut the 17 watt U/L Playmaster. One prob-concerns the heating of the back-bias resistor and another a strange noise emanating from the EL37s. He also wants to know if the connec-tions to the connections to the output transformer secondary are correct and how the old No. 6 Control Unit can be converted for RIAA curve leaving out the AES.

A. It is quite normal for the bias resistor to run at a fairly high temperature, but it would not be possible to know whether it was excessive in your case unless the current drawn by the output valves was checked. If excessive, the cause would have to be found and corrected. We cannot explain the noise in the valves which you describe, and suggest you take this matter up with the makers. The connections you show for the output transformer appear to be correct, the two 3.75 ohm windings in series giving 15 ohms. Converting the No. 6 Control Unit to the RIAA curve in place of the AES makes it virtually identical with the modified control unit you are already using. We suggest that a separate power supply would solve most of your motor-boating troubles.

R.J.M. (Leeton, N.S.W.) asks for an explanation for the noise introduced into an audio system when a finger touches a "hot" audio lead. While stray fields from the power mains explain this when the equipment is located near the power mains, an explanation is still needed to cover the case of a battery amplifier working well away from power lines.

A. The effect could probably be considered as a form of instability, various frequency components being roughly determined by the time constants of the amplifier, power supply, etc. The characteristic of the sound would also be affected by the electrical characteristics of the body touching the active lead. Where A.C. fields from the mains are present, then 50-cycle components would be present in greater strength than otherwise.

THE R., T.V. & H. CROSSWORD No. 42



ACROSS

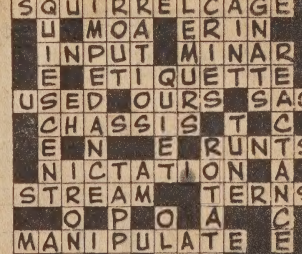
1. Winding on the input side.
4. Inductive component.
7. Said of radium.
12. Having no moral sense
13. Born.
14. Fabric with a corded surface.
16. Employment of methods (pl.).
19. Symbol for tantalum.
20. Opposite to right.
23. Piece of metal, having a head and point.
24. Loss of memory.
25. Hoarse cough.
27. To pull or tear off.
28. Pioneered conversion of matter into energy.
31. One's dwelling.
32. A look of scorn.
33. Point of anything.
35. Negative (abbrev.).
36. Impedance due to inductance or capacitance.
37. Suffix meaning act, being, or state of being.
38. To resist.

DOWN

1. Reciprocal of reluctance.
2. Denotes density of an electric or magnetic field.
3. Smallest particle.
4. Winding of conducting wire.
5. Unclosed.
6. Often used to mean outer atmosphere.
8. Inside of.
9. Principal artery from the heart.
10. Rises to the surface of milk.
11. Connection made at an intermediate point.
15. Examining for adults.
17. Infrequent occurrences.
18. Soft mud.
20. Man's name (abbrev.).
21. A resinous tree.
22. Inferior corn sifted out (pl.).
26. Please turn over (abbrev.).
29. Girl's name.
30. That is (abbrev.).
32. To ooze.
33. Prefix meaning three. (abbrev.).
34. Girl's name
35. Non-commissioned officer

Solution and further crossword next month

Last month's solution



Answers to Correspondents

F.K. (Tatura, Vic.) writes to say that he has not received the August issue and suggests that it may have gone astray. F.K. also has some appreciative comments regarding the quality of articles in our journal and goes on to relate his experiences with some Playmaster equipment. Our correspondent also wishes to know if the volume control between stages in control units is there for any particular reason.

It appears, also, that F.K. is having difficulty in obtaining a "wobbulator" unit, and wishes to know if we intend to describe an electronic version.

A. We regret that the August issue did not reach you, and a replacement copy has been forwarded. We note your appreciative comments with pleasure and trust that you will continue to enjoy our publication. The reason for the volume control between stages in our control units is to prevent overload of the second stage. Only if the input signal were of such a level as to make this possibility remote, would it be feasible to install the volume control after the stages.

There is a remote possibility that we may describe an electronic version of the mechanics' wobbulator some time in the future. There is also a possibility that a commercial unit may be marketed by one of the speaker manufacturers, similar to that used in our version.

R.L.F. (Becom, N.S.W.) is very interested in regenerative sets, but is conscious of the fact that these sets have no AVC and considers this a serious drawback. He wants to know whether it is possible to fit AVC to these simple sets.

A. As sure as we say it can't be done, R.L.F., someone is bound to point out that it has already been done. However, we are fairly safe in saying that there does not appear to be any practical way in which this can be done, particularly when it is remembered that these small sets are usually "flat out" anyway, so that there is no reserve of sensitivity to draw on when the signal weakens. In the event that the regenerative detector was merely part of a larger set, having one or more RF stages, it might then be possible to provide a worthwhile improvement in performance—but regenerative detectors are seldom used in large sets.

R.J. (Manning, S.A.) wants to know if we have ever described an oscillator suitable for Morse code practice and also makes some suggestions about using commercial coils for crystal sets.

A. We have described a number of Morse code oscillators in the past and that of April, 1942, would probably suit you best. A copy of this circuit is available through our postal service. Your suggestions regarding the crystal set are interesting, but the first part is not exactly correct. Far from being inefficient, the large hand wound coils are usually more efficient than the miniature commercial types. In the latter case space is sufficiently important to justify a compromise and, size for size, the modern miniature coil is a vast improvement over the older designs. However, for straight out performance it is hard to beat the designs normally used for crystal sets. The idea of using two tuned circuits is quite sound and has been used in two designs in our magazine, the Twin Tune Crystal Set (April, 1951) and the De Luxe Crystal Set, of August, 1954. However, it is not correct to assume that the use of trimmers will help performance where only a single tuned circuit is involved, though they are necessary where two circuits must be made to track.

R.G.P. (Norfolk Island) is interested in the Multi-Band Six receiver, which was described in the January, 1956, issue, but would like to build it without the audio section. The idea is to feed the output into a separate Playmaster amplifier. However, he wonders what to do about the diode section of the 6BD7.

A. Practically any diode could be used in place of the diode section of the 6BD7. The 6H6 or the diode section of the 6AV6 you mention would be ideal. The detector circuit may remain exactly the same as page 47 except that the shielded lead from the centre of the volume control should go to the input of the audio amplifier. Retain the O.O1 uF capacitor so that the D.C. voltage appearing across the volume control will not be passed on to the audio amplifier. Also, keep the shielded lead between the tuner and the audio amplifier as short as practical in order to avoid excessive loss at the high frequency end of the audio spectrum.

Let's Buy An Argument

(Continued from page 75)

If I seem to be concluding on a rather weak note, it is only because I am both dismayed and dispirited.

We make it a practice to check one another's proofs in a vain effort to eliminate typographical errors. By chance, Phil Watson checked the first couple of pages dealing with direct coupling and subsequently appeared in the office with wrinkled brow. (I refer to a gesture, not a state.)

It seems that he had just spent a whole evening in front of a directly coupled receiver, without seeing a single example of bad monitoring. In fact he rather likes direct coupling.

Et tu, Brute?

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FOR SALE: 122 Transceiver, new, with handbook, £20. Deliver Sydney. **Phone Gingkin 11 night.**

WANTED: Circuit or Handbook for TR 1143. Phone price, etc., to **Gingkin 11 night.**

FOR SALE: Back Nos. R. and H. for sale. April, 1939, to Oct., 1956, 2/- posted. Nov., 1956, to current copies 4/- posted, quote on large lots, also will buy spare R. and H. you have. If out of stock I will get it for you. **A. J. Cox, 13 Glover St., Belmont, N.S.W.**

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